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Extravesical Lesions Causing Bladder Neck Obstruction[1]

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OBSTRUCTION of the urinary bladder neck is the most common genito-urinary surgical lesion. In spite of this fact, it is the one condition for which patients more often consult the general practitioner or family physician than they do the urologist, the surgeon, or the gynecologist. Early medical literature abounds with articles describing various methods of relieving the distress in such cases, whether it be caused by a calculus, an enlarged prostate, or a new growth. Congenital abnormalities are probably the most common cause of urinary retention in infants and children, while in persons past middle life prostatic enlargement or neoplasms are to be suspected first. The diagnosis of urinary obstruction is accurate and the treatment is specific. Intelligent use and interpretation of cystoscopy, roentgenography, and physiologic chemistry against a background of history and physical findings make this possible.

Disturbances in micturition may be caused by mechanical impediments at the vesical neck. These mechanical impediments may or may not be a part of the genito-urinary system. Practically all of the various conditions causing bladder neck obstruction have been studied extensively, but the most intensive studies have centered about the prostate; other lesions are of equal importance but are less frequent. Bothe (1) in a discussion of bladder neck obstruction states that the causes may be congenital or acquired and may be classified as follows:

1. Hypertrophied tissue
2. Inflammation
3. Tumors: (*a*) malignant (*b*) benign
4. Neuropathic
5. Foreign bodies
6. Congenital valves

Foley (2) declares that one of the most important and in many ways the most difficult problems of urology is that furnished by obstruction to urination at the vesical neck. He further says that a large proportion of such obstructions are caused by benign hypertrophy of the prostate and are easily recognized, but that to think of prostatic hypertrophy as the only cause is to have a distorted view of the problem. He divides the causes of bladder neck obstruction into two classes.

EXTRINSIC
1. Bladder tumors
2. Vesical calculi
3. Foreign bodies

INTRINSIC
1. Disturbances of innervation
   (*a*) Central nervous system
   (*b*) Peripheral nerve lesions
   (*c*) Atony of the bladder
2. Anatomic changes
   (*a*) Inflammation
   (*b*) Neoplasms
   (*c*) Hypertrophy of the trigone

[1] Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

Fig. 1. Case I. Cervical uterine fibroid, with calcification. Film before cystogram, showing displacement of the urethral catheter away from the midline.

Several authors (3, 4, 5) describe unusual obstructions, without prostatic enlargement and other disturbances of micturition, from mechanical impediments at the vesical neck. Lazarus (3) states that obstructive lesions of the urogenital tract are conveniently divided into two groups, supravesical and intravesical, and in his enumeration of the types of lesions he places bladder neoplasms and diverticula obstructing the vesical outlet as next to last in incidence and retroperitoneal tumors as the most infrequent cause of such obstruction.

A review of the literature fails to show any study devoted to bladder neck obstruction from extravesical causes. There is, however, a group of extravesical lesions which, though uncommon, can give all of the historical and physical evidences of bladder obstruction. In fact, the obstruction can be confirmed by the same studies as for prostatic enlargement or any intravesical or urethral lesion causing obstruction. This confirmation, however, may not be necessary inasmuch as a pelvic, rectal, or roentgen examination will give the true location of the lesion. With recognition of the extravesical nature of the obstruction, its treatment will fall in the field of the general surgeon or of the gynecologist. During the past two years five such cases have come under our observation.

CASE I (Nov. 26, 1941): M. H., female, age 75, gave a history of urinary difficulty for two years, characterized by increased frequency with a sense of obstruction and inability to empty the bladder completely. These symptoms became progressively worse, terminating in complete retention prior to hospitalization. The general health was good. There was no history of vaginal bleeding or of pregnancy.

Examination of the abdomen showed a distended bladder reaching midway to the umbilicus. Catheterization was accomplished with ease. Routine urinalyses were negative. In routine blood studies the hemoglobin was found to be 70 per cent and the red cell count 3,640,000. Pelvic examination was difficult because of a mass largely occluding the vagina from the introitus to the vault. On vaginal and rectal palpation, under intravenous anesthesia, the consistency of the mass was that of an adenomatous enlargement of the prostate. A survey film of the abdomen showed calcification, evidently in a fibroid of the uterus. Cystograms, (Fig. 1) showed bladder displacement due to the extravesical mass. Cystoscopy was negative except for urethral pressure deformity.

Diagnosis: Complete bladder neck obstruction due to cervical fibroid.

Treatment: Vaginal enucleation of the tumor.

Result: Complete relief of symptoms.

CASE II (Dec. 14, 1942): G. S., male, age 68, was admitted to the hospital for the fourth time, the previous admissions having been for removal of a sacral chordoma. Following each removal there was a recurrence of the tumor. Entrance at this time was for urinary obstruction and overflow incontinence necessitating catheterization. The patient also complained of a sacral mass, low back pain, and bowel incontinence.

General physical examination showed severe emaciation. There was a large oval mass in the sacral region which encroached upon the rectum. Encroachment on the prostatic urethra was evident by rectal examination. The bladder was distended to the umbilicus. A cystoscope could not be introduced because of obstruction in the prostatic urethra. Cystograms showed a bladder deformity due to an extravesical mass. Cystometric examination was negative. Routine blood studies and urine examination gave normal findings.

Diagnosis: Bladder neck obstruction due to sacral tumor (chordoma) protruding into the pelvis.

Treatment: Permanent cystostomy.

CASE III (March 8, 1943): R. A. S., male, age 54, was confined to the hospital in November 1942 because of a lesion of the left ischium and pubis which roentgenologically showed extensive bone destruction and was subsequently diagnosed pathologically as sarcoma. At the time of the first admission there was incomplete urinary obstruction due to pressure from the extravesical mass occupying the left floor of the pelvis. The obstruction was relieved by a transurethral resection of the prostate, and the tissue removed failed to show any malignant change. The patient was discharged but continued to have pelvic pain and was later confined to his bed because of increasing weakness and edema of the left leg. His urinary difficulties, after leaving the hospital, were characterized by progressive frequency and decrease in size and force of the stream, terminating in complete obstruction before his final admission.

Examination at the time of the second admission showed anemia and emaciation. The bladder was greatly distended, lying as an ovoid mass in the right lower quadrant, with its upper border at the level of the umbilicus. In the left lower quadrant was a hard, fixed mass involving the structures of the inguinal region. A catheter was passed with great difficulty and the displaced bladder was emptied. There was enormous edema of the left leg and genitalia, and lesser edema of the right leg. Rectal examination showed a stony hard mass involving the prostatic area and apparently continuous with the left lower quadrant mass. In the routine blood studies the hemoglobin was 58 per cent, the white cell count 14,600, and the red cell count 2,880,000. An examination of the urine showed evidence of gross infection.

Death occurred on the fourth day of hospitalization. Autopsy revealed an extensive sarcoma involving the left half of the bony pelvis, extending beneath the peritoneum up to the left kidney, and displacing all of the soft tissue structures to the right. Cystograms (Fig. 2) were made postmortem.

Diagnosis: Sarcoma arising in the left bony pelvis; complete urinary obstruction.

CASE IV (March 17, 1943): C. S., female, age 40, had three attacks of acute urinary retention necessitating catheterization, during the eleven months prior to admission to the hospital. She had been repeatedly catheterized during the present period of obstruction. Her general health was good. There was no history of vaginal bleeding. There had been one pregnancy and no miscarriages.

General physical examination was negative. Abdominal examination revealed a tender distended bladder and after catheterization a mass could be felt above the pelvis. Pelvic examination showed a very large, hard, fixed tumor involving the uterus, which was retroverted and filled the entire cul-de-sac. Urine examination was normal. Routine blood

Fig. 2. Case III. Urethrocystogram, showing sarcoma of left pelvis protruding into the right side and displacing the bladder, with complete obstruction by pressure upon the vesical neck.

studies showed hemoglobin 70 per cent and a red cell count of 3,100,000. Cystograms (Fig. 3) showed bladder deformity.

Diagnosis: Retroverted fibroid uterus.

Treatment: Hysterectomy.

Result: Complete cessation of urinary symptoms.

CASE V (Aug. 5, 1943): R. B., female, age 43, sought treatment because of inability to urinate. She had required catheterization for six months prior to admission to the hospital and during this time she had had several episodes of partial obstruction. There were no other urinary symptoms nor was there any history of vaginal bleeding. The patient's general health was good; she had 5 children; no miscarriages.

General physical examination was negative. Abdominal examination was also negative except for bladder distention midway to the umbilicus. The patient was catheterized with ease. Pelvic examination showed the uterus to be about the size of a grapefruit, uniformly enlarged, and filling the pelvis. Routine urine and blood studies were normal. Cystograms (Fig. 4) showed a definite bladder deformity.

Diagnosis: Ptotic fibroid uterus with complete urinary bladder neck obstruction.

Treatment: Hysterectomy.

Result: Complete recovery from urinary symptoms.

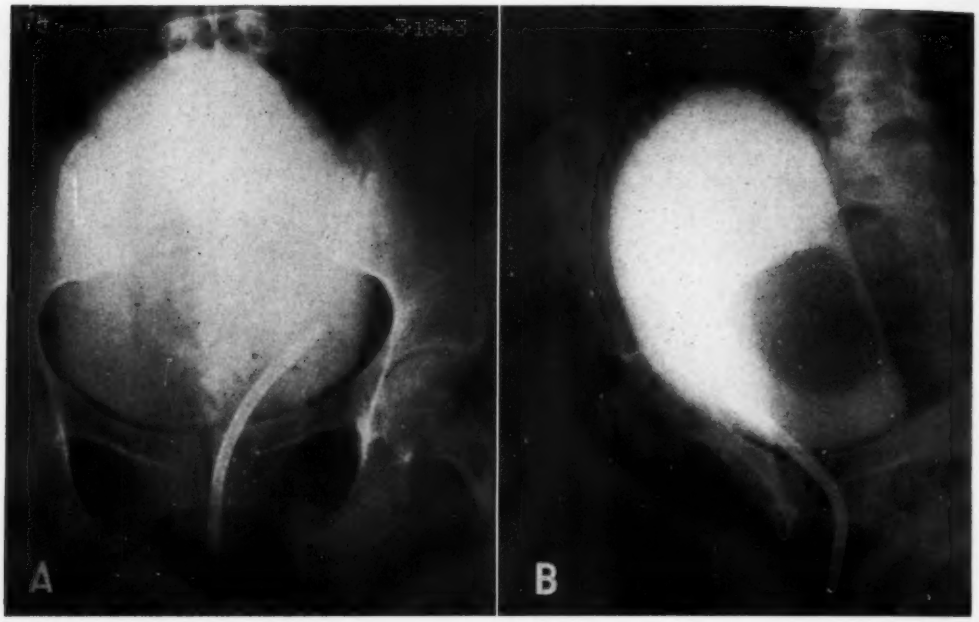

Fig. 3. Case IV. A. Displacement of catheter laterally, distended bladder, pressure defect. B. Defect in posterior aspect of the distended urinary bladder, pressure on vesical neck, anterior displacement of the catheter.

Extravesical lesions causing bladder neck obstruction should offer slight difficulty in diagnosis. They should be suspected if the cystoscopic examination is negative in the presence of a pelvic mass which persists after the bladder has been emptied. The extravesical tumors usually do not cause the rectal symptoms and venous stasis which accompany most retroperitoneal tumors, and for that reason the diagnosis of such lesions may be arrived at by the process of elimination.

In an analysis of the five cases presented it will be found that two general types of lesions enter into consideration. In the females, the lesions were in the uterus, while in the males the lesions were of bony origin.

Two of the females were multiparae and the other a nullipara. Deliveries in each of the child-bearing patients had been difficult and were followed by a marked relaxation of the pelvic floor, which, not being repaired, gave opportunity for prolapse of the heavy uterine tumor, thus blocking the introitus and, by continuity, the vesical neck. In the non-parous patient the neoplasm originated in the cervix of the uterus and by growth extension, rather than by prolapse, caused mass obstruction at the introitus and pressure obstruction at the vesical neck.

In the two males the lesions had their origin in bone contiguous to the pelvic floor and through tremendous growth pressed aside all soft tissue, finally to constrict and obstruct the fixed vesical neck. Osteomyelitis with soft-tissue abscess has been observed by one of the authors (R. K. R.) to cause bladder distortion and irritation, but never obstruction. Fractures of the bony pelvis cause obstruction by contusion or rupture rather than by pressure.

Lesions of the lower bowel involving the rectum, even though encountered frequently in a far advanced stage, rarely cause vesical neck obstruction. This is probably due to the natural mobility of the gut and to the pelvic fascia, which serves as an effective barrier. Carcinoma of the bowel, being a lesion of an organ

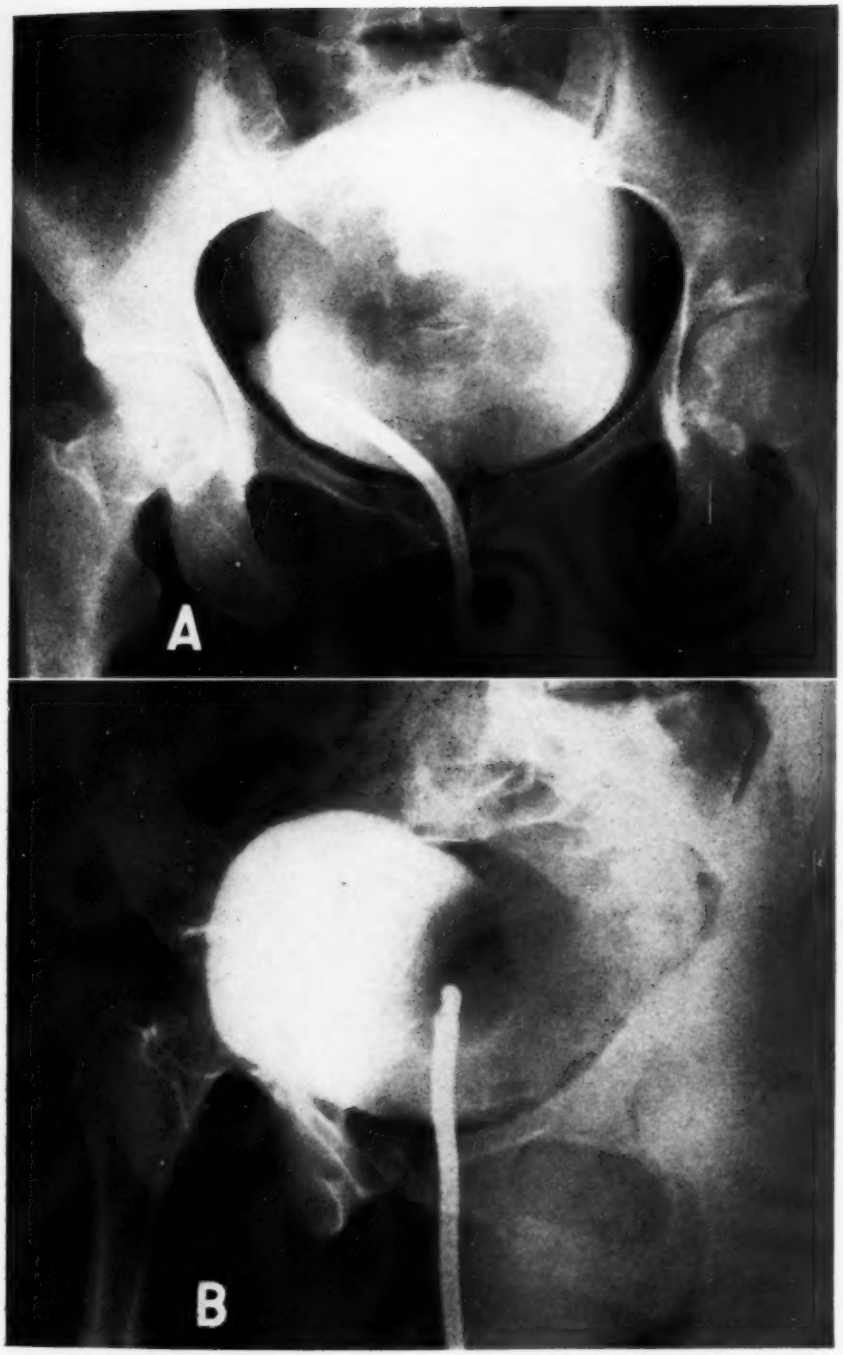

Fig. 4. Case V. Prolapsed uterine fibroid. A. Lateral displacement of urethral catheter. B. Oblique view showing filling defect posteriorly and displacement of the bladder anteriorly.

which is not anatomically fixed, could not then easily cause obstruction of the vesical neck by pressure but only by direct invasion, in which case it could not be termed extravesical.

TREATMENT

Treatment in cases of bladder neck obstruction should be instituted in order to relieve the obstruction and to restore the urinary organs to as near normal function as possible. Early treatment is indicated in order that kidney damage may not become so severe that it cannot be remedied. Blood urea determinations and kidney function tests should be performed in such cases of obstruction, so that the renal function may be known.

SUMMARY AND CONCLUSIONS

1. Five cases of extravesical lesions causing bladder neck obstruction have been presented.

2. A review of the literature has shown that such cases are infrequent or are not reported.

3. Points in differential diagnosis are brought out as related to the more common causes of urinary obstruction.

4. Emphasis is given to the possibility of extra-urinary tract causes of vesical neck obstruction.

5. In all cases of bladder neck obstruction, extravesical causes should be ruled out by appropriate studies. Careful pelvic and rectal examinations together with cystograms are the procedures to be used.

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BIBLIOGRAPHY

1. BOTHE, A. E.: Lesions Causing Obstruction at Vesical Neck. Pennsylvania M. J. **34:** 383–388, March 1931.

2. FOLEY, F. E. B.: Diagnosis and Classification of Various Forms of Bladder Neck Obstruction. Minnesota Med. **12:** 137–145, March 1929.

3. LAZARUS, J. A.: Obstructive Lesions Involving the Vesical Outlet. Am. J. Surg. **3:** 241–246, September 1927.

4. HIRSCH, E. W.: Cause of Urinary Retention Without Prostatic Hypertrophy. Illinois M. J. **56:** 203–205, September 1929.

5. CAULK, J. R.: Obstructions at Bladder Neck in Men, Women and Children. Ohio State M. J. **33:** 373–378, April 1937.

The Effects of Radiation Therapy in Clostridium Infection in Sheep[1]

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A LONG DELAYED decision to demonstrate, if possible, the effects of radiation therapy in gas gangrene by animal experimentation finally culminated in such an attempt beginning in March and continuing for nearly four months of 1942.

Sheep were chosen for the experiment at the suggestion of Dr. Sarah Stuart of the National Institute of Health, Washington, D. C., who not only gave this helpful advice but rendered other invaluable aid from time to time throughout the experiment. These animals are quite uniformly susceptible to *Clostridium* infection, they approximate man in size and weight, they are available in this vicinity and are comparatively easily handled, and when purchased out of a flock they have a common sire and an almost identical age.

We began the experiment with the conviction that radiation therapy does have a favorable influence in gas gangrene, both because of personal experience and the much richer clinical experience of others, notably Kelly (1) and Cantril (2). It is entirely reasonable to assume that infections produced by gas-producing organisms are no exception to the general rule, recognized by all radiotherapists worthy of the name, that radiation is a tremendously effective and valuable aid in the treatment of infection (5). Indeed, it would be nothing less than surprising if it could be convincingly shown that radiation therapy, which has long been recognized as a curative agent in the severe and ofttimes otherwise fatal cases of streptococcic infection about the head, face and neck, and of erysipelas, should prove *without* value in gas bacillus infection.

The importance of the size of the animal used in this experiment may be stressed, because in computing radiation doses the surface irradiated is a prime factor, and this is nearly equal in the sheep and the human subject. Dogs are notoriously immune to the pathogenic clostridial infections. This alone introduces an imponderable factor in determining the effects of any treatment (6), to which may be added the wide range in age, size, and blood lines in any kennel. We have found guinea-pigs unsuitable because apparently healthy animals have died when subjected to the amount of radiation recognized as a therapeutic measure in gas bacillus infection, namely, 200 r to 250 r repeated within twenty-four hours. There is no reason to speculate at length on this simple phenomenon when we consider that in exposing the hindquarter of a guinea-pig to radiation we are actually treating at least a third of the body surface and more than a third of the body volume. This, of course, is nothing more nor less than the operation of the inverse square law, which in the case of a small animal means that the radiation effects are distributed without much modification through that part of the body under the selected port. To this incontrovertible fact may be added the effect on sex organs and hollow viscera as well as the blood stream, all of which are relatively close to the target skin distance. These animals are also prone to chew at their wounds, which automatically establishes drainage and this, although crude, nevertheless approximates a treatment of known value in gas gangrene and appreciably vitiates experiments of a strictly non-surgical nature.

A strain of *Cl. welchii* designated as S.R. 12, which was isolated by Dr. Muriel Robertson of the Lister Institute, from a

[1] From the Radiologic Clinic of Drs. Groover, Christie, and Merritt. Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

fatal case of gas gangrene, was employed in this experiment. Twelve sheep were purchased from a flock in the Union Stockyard in Baltimore and were sold to us as yearling lambs having an average weight of 80 lb. Later, 4 others of a different breed were purchased; these were somewhat older, with an average weight of 120 lb. In the first 12 animals the minimal lethal dose of a twenty-four-hour meat-broth culture including spores, non-spores, and toxins was found to be 1 c.c., which amount caused death in an average of 105 hours. The same amount, however, was not definitely established as a minimal lethal dose for the 4 larger animals not of the same breed. Only 3 of these animals were used, however, and of these, one served as a control.

TECHNIC OF INOCULATION

The fleece of the entire right hindquarter of the animal was clipped closely to the skin. At approximately the central portion of the thigh on the lateral aspect, a skin incision 7 cm. in length was made and continued down deeply into the underlying muscle. A muscle bundle was then grasped with a Kelly clamp and thoroughly macerated *in situ*. After pressure control of the slight bleeding, 1 c.c. of the twenty-four-hour broth culture was injected into the macerated muscle and the wound was closed by two silk sutures. There were no material variations in this technic. Control roentgenograms, red and white cell counts, hemoglobin estimation, and rectal temperature were recorded prior to inoculation and at twenty-four-hour intervals thereafter. When the disease was well established as determined by the behavior and appearance of the animals, supplemented by blood findings and gas in the tissues, deep needle punctures were made through a shaved and carbolized skin area into the medial aspect of the thigh at least 12 cm. from the point of inoculation. In every instance where there was clinical evidence of the disease, *Cl. welchii* was recovered in pure culture and identified by smears, cultures, and rabbit inoculations. In several animals a 5 per cent glucose in normal saline solution was administered subcutaneously when death seemed imminent, but both treated and control animals received identical treatment in this respect. All dead animals were autopsied and photographed in Kodachrome.

THE DISEASE IN UNTREATED ANIMALS RECEIVING A MINIMAL LETHAL DOSE

A swelling at the site of inoculation appeared in about four hours after the injection, at which time the animal ceased eating and responded sluggishly to ordinary stimuli. No tissue gas could be demonstrated at this period. At the expiration of twelve hours, the swelling had increased in all directions but more apparently as it approached the knee joint. The affected member was favored and in some instances the animal, if standing, bore no weight on it. In general, there were marked acceleration of respiration and profound muscular weakness; animals normally difficult to restrain were limp and listless and could be handled with little or no manifestation of resistance. There was, as a rule, no significant rise in rectal temperature. Body temperatures alone were no index to the severity of the toxemia in any of the animals. At the end of twenty-four hours, the swelling of the affected member had increased and the characteristic odor of gas gangrene was easily detected in the vicinity of the sick animal. Free gas in the affected member could usually be determined by crepitation and x-ray studies at this time. The gas was located either in a considerable pocket at the site of inoculation or was distributed in finger-like projections along the fascial planes. The blood findings were striking and were similar to those reported by Gordon, Stewart, Holman and Taylor (3) in 1940. There was a considerable drop in the hemoglobin, with a pronounced reduction in the red cells, which in some animals amounted to 50 per cent of the normal. A gross clumping of the red blood cells could be easily ob-

served in the chamber of the red cell pipette. There was, as a rule, a temporary decrease in the leukocytes.

Those animals surviving the thirty-hour period were invariably prostrated, refusing food and water and unable to stand, or standing only with difficulty. The involved thigh and leg had increased in size two to three times the normal. The swelling had extended to the flank, across the perineum and along the lateral and ventral aspects of the belly. Bluish- or reddish-purple discoloration of the distended skin over the thigh, perineum, and flank was a constant observation, and the gas shadows were easily demonstrable in all the roentgenograms in every animal at that time. The hemolytic anemia became more pronounced and the clumping of the red cells more striking.

AUTOPSY FINDINGS IN ANIMALS DYING OF THE DISEASE

At autopsy the skin was found, on inspection, to be tense over the swollen thigh and leg. The perineum was discolored, presenting a dusky red and dark blue or blue-black appearance. When the skin was incised, a considerable quantity of malodorous serosanguineous fluid escaped. The muscles of the thigh were crepitant and felt distinctly spongy. Crucial incisions deep into the lateral thigh revealed a bubbling, spongy, dark red mass in which the integrity of the muscle was completely lost down to the femur. Muscle bundles, or their remnants, could be easily torn across with the fingers. The appearance of the gas-infected lesion was not unlike red hepatization of the lung in lobar pneumonia. As the skin was dissected or pulled away from the flank and torso, flame-like projections of infection were seen extending to and over the thorax on the affected side. There were no signs of free gas in the thoracic or abdominal cavities, and the viscera appeared normal except for distended loops of gut.

There was one exception to the general picture in an animal surviving twenty-seven and a half hours after inoculation and dying of an apparently overwhelming toxemia. Clinically there was profound muscular weakness seventeen hours after inoculation, followed by a comatose state until death. This animal received two adequate treatments, one of them an hour and forty-five minutes after inoculation and the second seven hours after inoculation (209 r and 214 r, respectively, to the inoculated thigh and leg). Hematuria was observed at the seventeen-hour period. The right thigh and leg were discolored a bluish red but there was not much swelling. There was no tension of the skin over the involved region.

Grossly in all the animals there was a wide subcutaneous hemorrhagic zone over the inoculated thigh, with extravasation of blood into the right groin. On cut section the muscle was spongy, gaseous, and darkly hemorrhagic, well into the mesial aspect of the thigh. Inspection of the viscera revealed a rather markedly hemorrhagic spleen with the remainder of the abdominal and thoracic viscera grossly negative. The kidneys were grossly normal.

Microscopic studies revealed congestion and edema of the heart, liver, spleen, and kidneys. There was cloudy swelling of the tubules, and the capsules were filled with fine granular and fibrous material. Study of the muscles of the thigh showed fragmentation and vacuolization of the fibers, congestion, and edema, with leukocytic infiltration and several hemorrhagic areas.

The highly objectionable penetrating and putrefactive odor of gas gangrene was present in every autopsied animal dying of the disease.

Death occurred in 3 animals twenty-seven hours after inoculation, and in 2 of these it was nearly simultaneous, being separated by a fifteen-minute interval. One interesting but wholly unrelated phenomenon was the swarm of bluebottle or carrion flies which suddenly appeared, seemingly from nowhere, as soon as the gangrenous areas were opened and as quickly vanished as deep burial of the carcass was completed.

THE DISEASE IN ANIMALS RECEIVING RADIATION TREATMENT

In general, the toxemia appeared to be modified in the treated animals, in that they were less inclined to lie down and some evinced earlier interest in food and drink, although there was no substantial difference from the controls in respect to body temperature, respiration, or blood findings. Actually, as a rule they appeared to be too ill to recover. There was one striking and constant difference between the treated and the untreated animals—in not a single instance among the former was there any evidence of spread of the infection across the perineum or along the flank on the affected side. The infection was confined to the inoculated thigh and leg in every irradiated animal. Several days following treatments, large fluctuating tumors developed. These were at first permitted to open spontaneously and in 3 animals small stab wounds were made above the knee joint, allowing large quantities (500–1,000 c.c.) of red raspberry-colored fluid to discharge. Ultimate recovery appeared to be uninfluenced by drainage, but there was little or no slough of the skin among the drained cases, whereas a considerable slough occurred when drainage was spontaneous. This we attributed to the long-continued distention of the skin and its subsequent necrosis. The slough of the muscle occurred at the point of inoculation, but this was limited to an area 4–5 cm. in diameter and of about the same depth. In the treated animals the *Cl. welchii* infection was arrested and the dominant secondary infection was invariably due to *Staphylococcus albus*, but in no instance was this the cause of death.

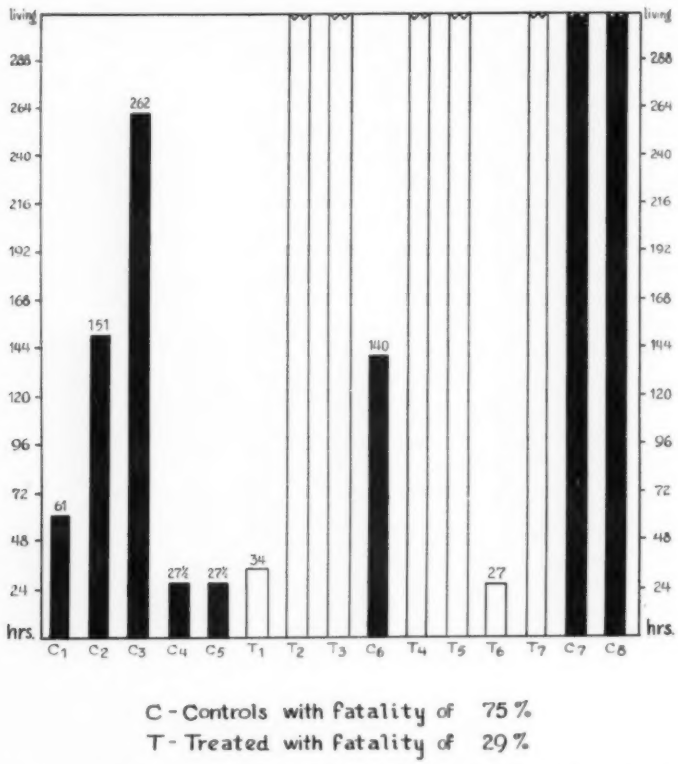

Fig. 1. Results of Clostridium infection in sheep, irradiated and unirradiated.

X-RAY EQUIPMENT USED AND TREATMENT FACTORS

The regulation U. S. Army mobile field unit was utilized for both radiographic and therapy technic. The apparatus was operated at 100 kv., 4 ma., and 1 mm. aluminum filter added (inherent filtration equivalent to 0.25 mm. aluminum). The focal skin distances were 37 and 55 cm., respectively, depending upon the size of the field indicated. At 37 cm. focal skin distance the size of the field was 30 cm. square; at the 55 cm. focal skin distance the size of the field was such as to include all of the thigh to a point below the knee. The portion of the abdomen included in the field, as well as the underlying opposite leg and distal portion of the thigh, was protected by strips of lead.

The output of the apparatus, measured in air, at 37 cm., was 19.5 r per minute; at 55 cm., it was 9.1 r per minute.

SUMMARY

1. In all of the untreated animals not dying within the first thirty-six hours, the gangrenous process was much more extensive than in the treated animals. This was marked by extension of the gangrene into the deep muscles of the leg to the femur, while in the treated animal the disease in all cases extended no deeper than the superficial muscles.

The disease in the untreated animals was of wider peripheral distribution, extending across the perineum and into the sacral region and across the flank, whereas in the treated animals it was in all cases restricted to the muscles of the inoculated thigh.

2. The immunity of all animals should be determined by blood serum agglutination titration before their use for experimental purposes, and animals showing immunity should be discarded.

3. The minimal lethal dose was not determined for 4 additional sheep of a different breed procured from a different locality and averaging 40 lb. more in weight. All of these factors are important in the response of the animal to the disease. The mortality in the untreated animals was 86 per cent before including the additional animals in the experiment, as compared with 75 per cent after including them. The mortality in those receiving therapy was 25 per cent before including the additional animals as compared with 29 per cent after including them.

As is shown, the addition of the new strain of sheep modified the results to a considerable extent, this strain being more resistant to the disease.

The amount of irradiation therapy given varied from 600 to 1,600 r total dose, but the amount given is no criterion as to the results obtained. Every treated animal was regarded as an individual case and treatment was given according to the severity of the disease and the general condition. Those animals, receiving over 1,000 r received their initial treatment late; they either died, or their disease ran a protracted course with eventual recovery.

It was found that recoveries were better and faster in the animals receiving an early initial treatment of 300 r with a second treatment of at least 200 r within six hours. The subsequent treatments depend entirely upon the course and severity of the disease and there are no absolute criteria for the therapy other than to treat early and adequately.

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REFERENCES

1. KELLY, JAMES F., AND DOWELL, D. ARNOLD: Twelve-Year Review of X-Ray Therapy of Gas Gangrene. Radiology **37:** 421–438, October 1941.

2. CANTRIL, SIMEON T.: Roentgentherapy of Gas Bacillus Infection. Radiation Therapy (supplement to Staff Journal of the Swedish Hospital, Seattle, Wash.) No. 2, pp. 95–103, May 1941.

3. GORDON, W. S., STEWART, J., HOLMAN, H. H., AND TAYLOR, A. W.: Blood Changes and Post-Mortem Findings Following Intravenous Inoculation of Sheep with Culture Filtrates of Cl. welchii, Types A, C, and D. J. Path. & Bact. **50:** 251–269, March 1940.

4. DOWDY, A. H., AND SEWELL, R. L.: Roentgen Radiation in Experimental Clostridium welchii Infection in Dogs: Preliminary Report. Radiology **37:** 440–442, October 1941.

5. CALDWELL, G. A., AND COX, F. J.: Roentgen Ray Treatment of Gas Gangrene: Clinical and Experimental Observations. Ann. Surg. **114:** 263–273, August 1941.

6. Experiments by Mayo Foundation during World War 1917–1918. J. Am. Vet. M. A., February 1942.

Effect of X-Ray Irradiation Upon Bacterial Toxemia in Rabbits[1]

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IN A PREVIOUS publication in this journal the writers presented experimental data which showed that in rabbits x-ray irradiation caused the production of non-specific antitoxin. Forty-eight hours after receiving approximately 100 r over the abdomen these animals were able to survive the intraperitoneal administration of a quantity of bacterial toxin which was constantly lethal to the untreated control animals. Two types of toxin were used, a standard diphtheria toxin (supplied by Eli Lilly & Co.) and one produced in our laboratory, a heat-killed culture of a hemolytic *E. coli*. The antitoxin resulting from irradiation was present in both the peritoneal fluid and blood serum. Time was required for its production or elaboration. Although present twenty-four hours following irradiation, it reached maximal concentrations only after forty-eight hours.

These experimental findings suggested certain related problems for investigation. A report of these studies follows.

I. TISSUE SPECIFICITY

Since only the abdomen had been irradiated in the previous experiments, there evolved the question whether this response to irradiation might be peculiar to the peritoneum or certain of the abdominal viscera. It seemed desirable, therefore, to determine the response of the other portions of the body—the chest and extremities—to irradiation.

Twenty-four rabbits were given approximately 100 r each, one half of the animals receiving the rays over the chest and the other half over the extremities. The remaining portions of the body were protected with lead and radiation was administered through one port. It was delivered through an inherent filter of 3 mm. aluminum and an added filter of 0.5 mm. copper and 1 mm. aluminum, at 50 cm. target-skin distance, at 140 kv. p. and 15 ma. The intensity of the beam was 20 r per minute, measured in air. The dosage was determined by the duration of exposure and was varied accordingly. Forty-eight hours later one-half of the animals in each group received a minimal lethal dose of diphtheria toxin and the other one-half a minimal lethal dose of the hemolytic *E. coli* toxin. The latter consisted of 4 forty-eight-hour agar slant cultures which had been heat-killed. Six untreated animals were given the same dose of the toxins and acted as controls, 3 for each toxin. All controls died within forty-eight hours. All irradiated animals which received diphtheria toxin survived, as did 9 of the 12 which received the hemolytic *E. coli* toxin. Of the 3 that died, 2 were irradiated over the chest and 1 over the extremities.

From the results of these experiments it may be concluded that antitoxin is produced or elaborated in response to x-ray irradiation irrespective of the portion of the body irradiated. If the sole benefit from irradiation in the treatment of infection is the production of antitoxin, then it is unnecessary to deliver the rays into the infected tissue. Equally good results should follow irradiation of the uninvolved portions of the body.

II. MINIMAL DOSE

It also seemed desirable to determine the minimal dose of radiation required for the production of antitoxin.

Four groups of 8 rabbits each were irradiated over the abdomen, the animals in Group I receiving 50 r; Group II, 30 r; Group III, 20 r; Group IV, 10 r. The factors were the same as those used in the

[1] Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

first experiment with the exception of the exposure time. This factor was altered as necessary to obtain the desired gradations of dosage. As in the previous experiment, all animals received intraperitoneal injections of the toxins forty-eight hours after irradiation. Also, 6 unirradiated animals were given the toxins and served as controls. All controls died within sixty hours. Of the 24 rabbits in Groups I, II, and III, 19 survived. Two fatalities each occurred in Groups I and III and one in Group II. In Group IV only one of the 8 animals survived.

These data establish 20 r as being the approximate minimal effective dose for rabbits. Furthermore, this amount of radiation appears to be as productive of antitoxin as the larger doses.

III. IRRADIATED WHOLE BLOOD AND PLASMA

The source of antibodies has never been established. It has been suggested, among other theories, that they are derived from disintegrated leukocytes. It is known, however, that these bodies are contained in the globulin fraction of the plasma. With this theoretical conception and this established fact as a basis for speculation, it was decided to determine the effect of direct irradiation of whole blood and plasma.

Six hundred and twenty cubic centimeters of whole blood were obtained from 20 stock rabbits. One portion of 250 c.c. was defibrinated as it was withdrawn and the remainder, which was citrated, was centrifuged and yielded 180 c.c. of plasma. Both the defibrinated blood and plasma were irradiated with 100 r, the factors being the same as in the first experiment, and then incubated at body temperature for forty-eight hours. One hundred and twenty-five cubic centimeters of serum were recovered from the irradiated defibrinated blood. These collections of plasma and serum were divided into lots of 14 c.c. each, and each lot was mixed with 1 M.L.D. of hemolytic *E. coli* toxin and incubated for four hours. Each lot was then injected into the peritoneal cavity of a stock rabbit. One of the animals died immediately following the injection, from cause undisclosed by postmortem examination. Of the 12 remaining animals 3 survived. There were also 3 survivors in the group that received the mixture of serum and toxin. The potency of the toxin was checked on 6 control rabbits, all of which died within thirty-six hours.

The problem was restudied with another series of controls. Eighteen rabbits were subjected to a procedure identical to that described above in every detail except that the serum and plasma were not irradiated. Of the 9 animals which received the plasma-toxin mixture 2 survived, and of the 9 which received the serum-toxin 4 survived. All animals which died after receiving the toxin combined with serum or with plasma, whether irradiated or non-irradiated, lived longer than the controls which received only the toxin.

It is apparent that serum and plasma afforded some degree of protection against the toxin used in these experiments. From the fact that the normal non-irradiated was as effective as the irradiated plasma and serum, it may be concluded that irradiation did not increase or in any way alter the factor which is responsible for protection against the toxin and which is present in normal plasma and serum. This raises the question for speculation as to the source of increased protection from the normal plasma and serum which were administered. It is probable that it merely added the antitoxin which it contained to that normally possessed by the animals and that this prolonged life in all and made survival possible in a few instances. Another explanation suggests itself. In the unprotected animals the toxin caused profound shock within four or five hours. The plasma and serum may have contributed only the therapeutic benefit derived from these substances in the treatment of shock.

CONCLUSIONS

1. In rabbits x-ray irradiation causes the production or elaboration of a non-

specific antitoxin. In previous publications, it has been suggested by the writers that this antitoxin is produced by the tissues, probably in response to the insult of the x-rays to the cells.

2. Antitoxin is produced irrespective of the portion of the body irradiated.

3. Twenty roentgens is approximately the minimal dose required to produce an effective quantity of antitoxin in rabbits.

4. Plasma and whole blood do not produce the antitoxin in response to irradiation, nor does irradiation seem to alter the antitoxin that they may normally contain. It would appear that the antitoxin demonstrable in plasma following irradiation is produced in tissues other than blood.

5. These observations made upon rabbits may or may not have counterparts in man. This paper is not concerned with that problem or the controversy regarding the value of x-ray therapy in infection.

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REFERENCES

BISGARD, J. D., HUNT, H. B., NEELY, O. A., AND SCOTT, P.: Experimental Studies of the Mechanism of Action of X-Ray Therapy upon Infection. Radiology **39:** 691–694, December 1942.

BISGARD, J. D., HUNT, H. B., NEELY, O. A., AND SCOTT, P.: Mechanism of Action of Roentgenotherapy upon Infection. Ann. Surg. **115:** 996–1006, June 1942.

Roentgen Therapy in Gas Bacillus Infection

Report of Nine Cases with Recovery

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KELLY's statements (1) define our position relative to the status of x-ray therapy as an adjunct to surgery in the management of post-traumatic gas bacillus infection. Merritt's description of experimental gas bacillus infection in sheep (2) should answer those (3) who state that "attempts to reproduce clinical effects in animal experiments thus far have failed."

The cases here presented[2] are described in some detail to demonstrate that x-ray therapy can in itself, or in conjunction with surgery, save patients who have an overwhelming gas bacillus infection superimposed upon the shock of severe trauma. The reports also indicate that, while the management of each case is as individual from the x-ray therapy point of view as from the surgical, underlying principles of radiotherapy are utilized in each instance as basically as are the fundamental precepts of surgery in its contribution to the treatment.

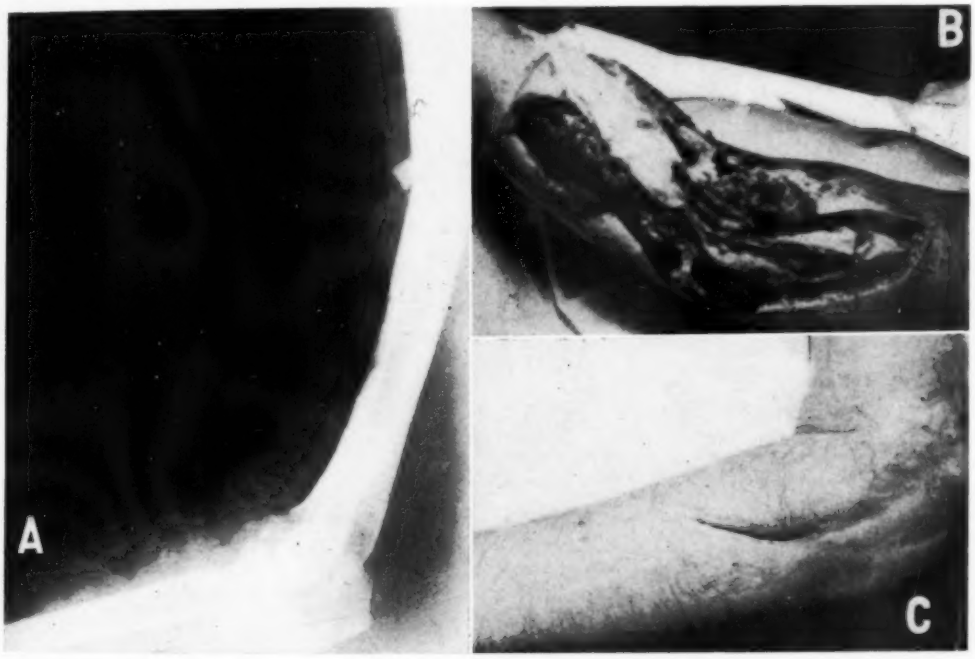

Fig. 1. Case I. Compound fracture with deep lacerations, complicated by gas bacillus infection. A. Linear distribution of gas around the elbow joint and upper forearm with a pocket of gas anterior to the fracture. B. Photograph taken after débridement. C. Ultimate result.

We are grateful for the confidence and support of the orthopedic surgeons of our hospital, who consider x-ray therapy an

[1] From the Tumor Institute of the Swedish Hospital, Seattle, Wash. Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

[2] Cases I to V were included in an earlier report (4). The x-ray therapy in the first two of these cases was managed by Dr. John Wirth, our predecessor at the Tumor Institute.

indispensable agent in the management of gas bacillus infections.

CASE HISTORIES

CASE I: W. H. S., a white male 58 years of age, was admitted to the Swedish Hospital Aug. 31, 1936, twenty-four hours after an automobile accident in which his left arm had been pinned under the car. He sustained a compound fracture of the central portion of the shaft of the left humerus and a deep laceration of the left forearm and distal arm with a dislocation of the left shoulder. Gas bacillus infection was already well established at the time of admission. The wound had been sutured and when it was opened foul smelling gas and discolored blood escaped. Smears of the material showed many organisms resembling *B. welchii*. Subsequent cultures produced gas. The wounds were flushed out by Dr. Roger Anderson and packed with vaseline gauze. The distribution of gas in the soft tissues can be seen in Figure 1. Roentgen therapy was given twice daily for three consecutive days and again on the fifth day. In the first four days the patient received 190,000 units of gas bacillus antitoxin. Recovery ensued without resort to amputation; the present disability is a result of injury to the musculospiral nerve.

CASE II: R. T., a boy 8 years of age, was admitted to the Swedish Hospital May 28, 1937, with a compound fracture of both radius and ulna above the wrist. Roentgen therapy was begun forty hours after the injury, when gas bacillus infection had spread upward, crepitus appearing under the pectoral muscles. There was a partial ischemia of the hand before treatment was begun. After three days of roentgen irradiation, the crepitus and swelling of arm and axilla had disappeared and the general condition of the patient had greatly improved. Gas bacillus antitoxin, 110,000 units, was given during the first four days. There was a progressive ischemia of the hand, resulting in a demarcated line of gangrene at the elbow. Amputation was done by Dr. Roger Anderson fourteen days after injury. There was no subsequent reinfection of the wound.

CASE III: H. P., a white male 50 years of age, was admitted to the Swedish Hospital Jan. 9, 1941. Five days prior to admission he sustained a compound comminuted fracture of the right tibia and fibula when hit by a rolling log. At that time the wound was treated by débridement and the parts were aligned as well as possible. The patient received sulfanilamide, 90 grains, during the first twenty-four hours after injury, with a change to neoprontosil intramuscularly on the second day because of vomiting. On the third and fourth days, he received sulfathiazole, 60 grains daily. When first seen by us, he was severely toxic. The entire lower extremity was greatly swollen (Fig. 2). There was a laceration at the site of bone extrusion about 2 inches above the ankle, through which gas could be expressed. A large laceration at the junction of the middle and lower third of the left lower extremity anteriorly was surrounded by an area of gangrenous skin over a distance of about 6 inches. Gas was escaping through this break in the skin. Crepitus extended from the ankle to the lower part of the knee.

Fig. 2. Case III. Swollen leg with gas bacillus infection, lacerations, and compound fracture.

Roentgen therapy was begun on the evening of admission to the hospital, five and a half days after injury. The entire lower extremity up to the inguinal region was treated two or three times daily for the first four days. The gas was less widespread on the second day after beginning treatment and on the third day was localized around the wound. Thereafter treatment was given, at first twice daily and then once daily, to the leg only, the *total duration of treatment being thirteen days*. Crepitus was absent on the eleventh day. Débridement of superficial sloughing skin was done on the eleventh day and on the sixteenth day a more extensive débridement and realignment of the fracture fragments, with in-

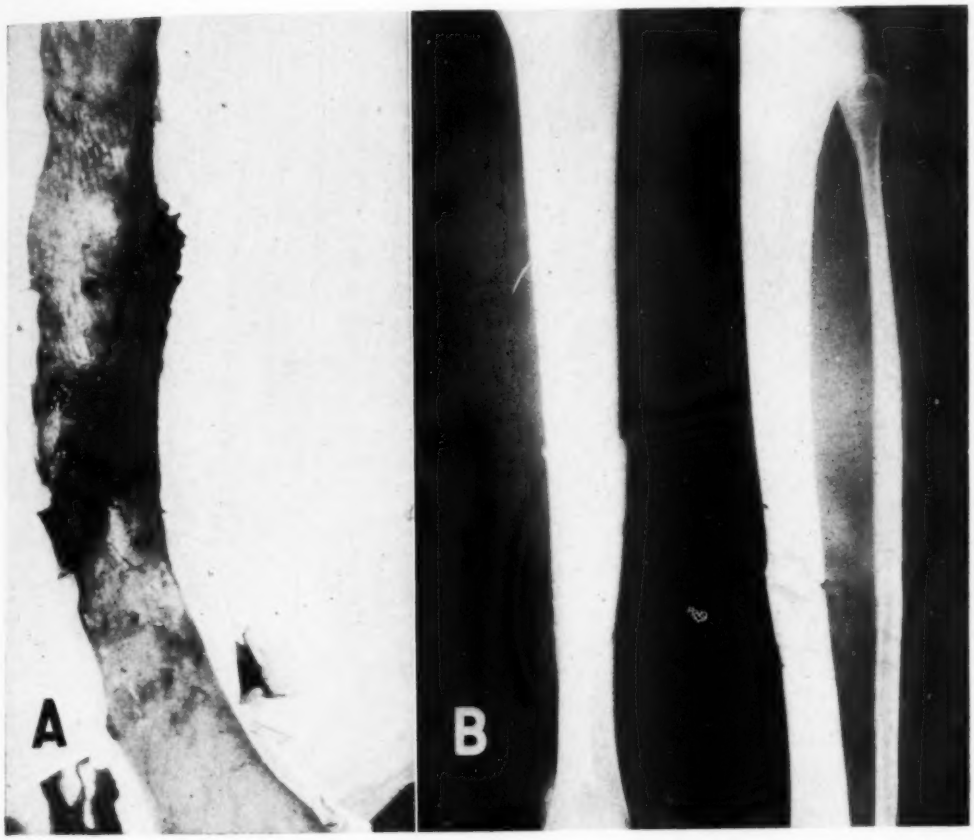

Fig. 3. Case IV. A. Gangrenous leg on admission, nine days after injury. B. Diffuse soft-tissue infiltration by gas.

sertion of a pin in the os calcis, were done by Dr. John LeCocq. The patient received multiple blood transfusions during the first three days as well as a total of 90,000 units of gas bacillus antitoxin during this period. Chemotherapy was begun after negative cultures for gas bacillus were obtained.

In this patient cultures of pus from the open wound were positive for gas-forming bacilli for forty days after admission, although roentgen therapy was discontinued after the thirteenth day because crepitus was absent, the temperature was 100° to 101° by rectum, and the general condition excellent. Application of chlorazine (2 per cent) packs was begun on the seventeenth day, which greatly improved the secondary infection and cleaned up the denuded surfaces remarkably well. Doctor LeCocq began the instillation of sulfathiazole solution directly into the wound on the day after the appearance of the negative cultures. After the wound had been cleansed and granulations were appearing, he proceeded with the major orthopedic repair—realignment of fragments and fixation by pins and plaster. In order to promote union of the fragments it was necessary for the patient to wear a walking cast after leaving the hospital. There was no subsequent infection. The only further complication was a late bone sequestrum, which was extruded.

CASE IV: H. M., a white male 24 years of age, was admitted to the Swedish Hospital on Feb. 16, 1941, having sustained a compound comminuted fracture of both bones of the left leg nine days before. The leg had been crushed between cars in a coal mine and was in a cast. At the time of admission the patient was extremely toxic. His temperature was 101°, pulse 112, red blood count 2,200,000, hemoglobin 42 per cent, and white blood count 19,000. When the cast was split by Dr. Roger Anderson, one could see a severe contusion of the lower half of the leg with necrotic skin and muscle bathed in foul-smelling pus (Fig. 3A). There was a sutured incision extending from the knee on the medial side obliquely across the leg to the junction of upper and middle third. From there on the wound was gaping. Crepitus extended from the ankle to just be-

Fig. 4. Case V. Extensive gas bacillus infection of scalp, face, and neck resulting from scalp lacerations: before treatment (left), seven days later (center), and on discharge (right). The scalp wound healed by granulation.

low the knee joint anteriorly, with boggy pockets both laterally and medially in the calf. The foot was moderately cyanotic with reduced peripheral temperature and diminished sensation. Clinically the appearance was that of a gas bacillus infection. During the nine days before admission to the hospital the patient had received sulfanilamide, the exact amount of which we could not determine.

Roentgen therapy was begun on the night of admission and irradiation was given to the entire lower extremity twice daily for the first three days. On the third day the cyanosis and pain in the foot were increased, although the temperature and pulse were coming down. The original smears and cultures from the wound did not show organisms resembling *B. welchii* and no gas was produced in cultures. Subsequent cultures also failed to produce gas; yet the clinical appearance gave every indication of gas infection. The diffuse soft tissue distention by gas is well demonstrated in the roentgenogram (Fig. 3B). Smears and cultures were largely productive of streptococci, and for that reason Doctor Anderson began administration of sulfanilamide orally on the third day, continuing it through sixteen days, with an average daily dose of 45 grains. Roentgen therapy was continued. On the fifth day the temperature was normal, yet one could elicit crepitus throughout the wound. The cyanosis of the foot was daily more noticeable and was accompanied by increasing pain at the ankle.

On the ninth day, because of the gangrene of the foot, Doctor Anderson amputated below the knee. Amputation was done through an area of previous contamination; yet the postoperative course was satisfactory from the point of view of wound infection and the stump remained free from gas infection. Cultures were taken from the deeper portions of the amputated leg and all of these produced abundant amounts of gas in culture. A rabbit inoculated intraperitoneally and killed after five minutes showed the foamy liver (after twelve hours' incubation) characteristic of gas bacillus infection. Organisms isolated from the animal proved to be *B. welchii*.

We were at a loss to explain the negative smears and cultures in this case during the first seven days under our care. We conjectured that the previous course of sulfanilamide, during nine days before the patient came into the hospital, might possibly have altered the infection, thus accounting for our failure to grow gas-forming organisms. That we did obtain virulent *B. welchii* from the deep pockets of the amputated leg showed us rather that we had not been obtaining our cultures from locations representative of the true bacterial invasion.

A dissection of the amputated leg showed a thrombosis of the posterior tibial artery at the ankle and of the posterior tibial vein deep in the calf.

CASE V: R. T., a white male about 50 years of age, was admitted to the King County Hospital with scalp lacerations and signs of concussion and was discharged with directions to have the dressings changed in the Out-Patient Clinic. He was seen by us in consultation four days after injury, when he was practically moribund. There was a gas bacillus infection involving the entire scalp, face, and neck, with gas exuding from the scalp wound. The eyes and nose were closed by the pressure of entrapped gas. Roentgen irradiation was given through multiple fields to the entire head, neck, and upper thorax on the afternoon on which the patient was first seen. The sutures were then removed from the scalp wound to permit more ready exit of gas. Two ampules of therapeutic gas bacillus antitoxin were also given, which caused a severe subsequent serum reaction.

The patient was treated by Dr. George Bracher and ourselves on seven days *over a total period of ten*

Fig. 5. Case VI. Multiple fractures of the foot with gas bacillus infection in the soft tissues.

days, radiation being given twice daily for the first three days. Six fields were used to irradiate completely the scalp, face, neck, and upper thorax. A smear and culture of pus from the scalp wound on the day of admission contained *B. welchii* and streptococci. The first smear and culture without gas bacilli appeared on the fifth day after beginning roentgen irradiation. Cultures were thereafter free from gas bacilli but contained streptococci. Sulfanilamide was not begun until the ninth day, that is, four days after gas bacilli could no longer be demonstrated.

Dr. W. E. Watson, the surgical resident, was most co-operative in caring for the wound. It became necessary for him to drain burrowing abscesses under the scalp. A normal temperature was obtained on the sixteenth day, and the patient was discharged on the thirty-first day with a granulating wound.

We feel that this case (Fig. 4) is ample evidence that roentgen irradiation should be given to any patient with gas bacillus infection regardless of the apparently hopeless situation at the outset.

CASE VI: S. R., a white male 57 years of age, was admitted to the Swedish Hospital on April 18, 1941. He had been injured on March 31 by a falling log. A laceration over the outer aspect of the right ankle had been sutured immediately following injury. The patient had been hospitalized elsewhere, and treatment to the injured foot and ankle had been in the form of hot soaks and external heat. While in the hospital he had received a total of 28 grams of sulfathiazole over a period of eight days. Infection in the foot had precluded the application of a cast for existing fractures, and it had been necessary to drain abscesses by incision through the heel as well as in the region of the inner malleolus.

On admission to the Swedish Hospital (by Dr. Roger Anderson), the entire right foot was greatly swollen, the swelling extending for about 8 cm. above the ankle. There was pitting edema over the dorsum of the foot. Over the posterior aspect of the heel was a deep laceration, with an area of gangrenous skin about 10 cm. in diameter extending from the heel up the lateral margin of the foot above

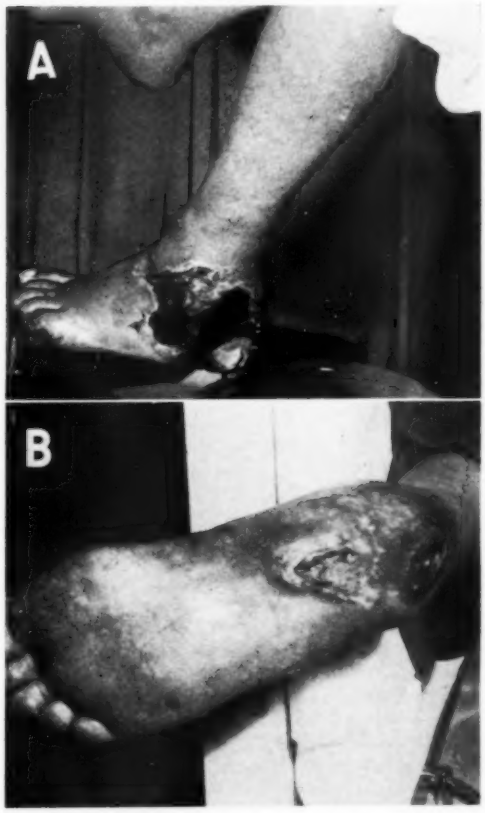

Fig. 6. Case VI. A. Gas bacillus abscess and gangrene with demarcation over the posterior and outer aspect of the foot. B. Condition of foot one year after injury. Reconstructive surgery had been unsuccessful in producing a functional result. Amputation was subsequently done.

the external malleolus. The area of gangrene extended onto the sole and upward to the inner malleolus, where there was a break in the skin through which gas and pus were escaping. Crepitus extended from the heel to the mid-portion of the sole and along both malleoli. There was no crepitus over the dorsum of the foot or above the malleoli. The color of the toes and dorsum of the foot was

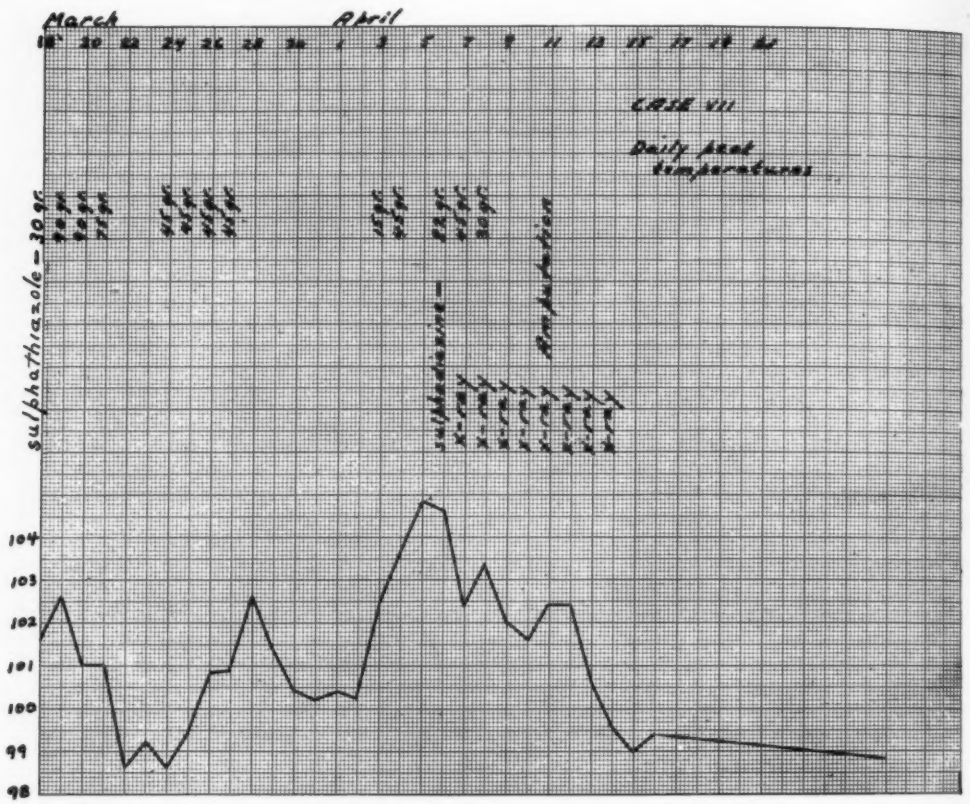

Fig. 7. Case VII. Daily peak temperatures.

good. Sensation was lost over the fifth toe of the right foot. Vessels at the malleolus could not be palpated because of the swelling.

The patient was fairly comfortable. His temperature was not above 100.8°; the pulse was 120; white blood count 19,000 with 86 per cent neutrophils; there was no anemia.

X-ray examination showed a fracture of the os calcis, a transverse fracture of the fifth metatarsal, and a fracture of the fibula just above the ankle. There was a considerable amount of gas in the soft tissues, particularly about the os calcis and ventral surface of the foot (Fig. 5). Cultures of pus exuded from the heel and inner aspect of the ankle produced extensive amounts of gas, and smears demonstrated bacilli of the gas-forming group.

Roentgen therapy was begun immediately and given twice daily for the first seven days and thereafter once daily for five days. The entire leg was treated for the first three days, after which treatment was confined to the ankle and foot. The foot at each treatment was irradiated through medial, lateral, and plantar fields so that it would receive radiation in its entirety. At completion of the treatment, on the twelfth day, there was still some gas present in the deep fracture of the os calcis but no demonstrable crepitus was elicited elsewhere. The patient was free from pain; temperature and pulse were normal.

At this time Doctor Anderson was not certain that, even though the infection could be brought under control, he would be able to reconstruct a useful foot after the extensive slough of os calcis and soft tissue of the heel which seemed unavoidable. He yielded, however, to our urgency and embarked upon what we felt to be the more conservative plan, an attempt to save the foot and later to reconstruct it. He accordingly waited for demarcation of the gangrenous skin over the heel and outer malleolus and then attempted débridement (Fig. 6A). His initial judgment proved subsequently to have been correct, and had it been followed would have saved the patient eighteen months of time spent in reconstructive surgery.

On May 31, or thirty-two days after the last x-ray treatment, the cultures of pus became negative for gas. At this time the entire os calcis sloughed and there was a huge defect which included the

Achilles tendon and a large part of the soft tissue of the heel, extending down onto the plantar surface. Chlorazene solution soaks were used as a dressing. By June 8 the patient was up on crutches and on July 30 he left the hospital, to return at a later date for plastic reconstruction.

The patient was readmitted Sept. 10 and several times thereafter and an attempt was made to rebuild the foot. This was particularly difficult because of the loss of os calcis and failure of skin grafts to take completely over the region of the heel. The result on April 27, 1942, about one year after injury, is seen in Figure 6B. Amputation was finally done in October 1942, as it was felt that an artificial foot would be more serviceable.

CASE VII: C. S., a white male of 26 years, was admitted to the Swedish Hospital, March 18, 1942. On March 13, a horse which the patient was riding tripped and fell on his left ankle. He managed to remount and ride 20 miles to the nearest doctor. He had sustained fractures of the left tibia and fibula, which were set in a plaster cast, with the insertion of pins to aid alignment. Two days later the foot began to swell.

On admission to the Swedish Hospital (by Dr. Roger Anderson) on March 18, the entire leg, ankle, and foot were edematous and blue. There were blebs over the foot and ankle. The tips of the toes were dry, hard, and black, with loss of sensation. The cast was split and the pins were removed on March 26.

From March 18 to March 28 the patient was given sulfathiazole—an average of 50 grains daily for ten days. Administration was interrupted for six days in favor of sulfadiazine. The daily peak temperatures under chemotherapy are recorded in Figure 7.

We were asked to see the patient on April 7, when it was believed that gas bacilli were present. At that time there was an extensive edema of the leg extending from the knee downwards. There was a dry gangrene of all the toes extending onto the dorsum of the foot and the plantar surface in its entirety. There were numerous blebs over the foot. Gas and pus were exuding from the site of previous transfixion just above the ankle, where there was a sloughing area about 3 cm. in diameter. There was crepitus throughout the entire leg, more pronounced in the mid calf. The dorsalis pedis artery was not palpable. Gas in the tissues could be palpated up to the lower margin of the knee joint. The odor was that of extensive necrosis. The pulse was 120 but of good quality; temperature 102.4°.

The x-ray examination showed a fracture of the left tibia and fibula (Fig. 8), with an extensive gas infiltration of the tissues. The patient was not severely toxic in spite of the high temperature and the accelerated pulse. The white blood count was 19,600 with 60 per cent neutrophils.

The problem at this time was not to save the extremity, but to improve the general condition and permit amputation under more favorable circumstances. It was agreed that chemotherapy was to be discontinued, but due to a misunderstanding of orders it was continued for three days longer. X-ray therapy was begun on April 7 and given twice in twenty-four hours, for four days, to the entire leg, through six contiguous fields. On April 11 (five days after beginning x-ray therapy) the temperature had dropped to 101.6° and the pulse from 120 to 92. There was, however, an extensive accumulation of pus within the leg which had no adequate drainage, and the gangrene of the part was almost complete. Amputation of the foot just above the ankle was done on April 11, and incision was made over the lateral aspect of the leg to promote drainage of pus. The muscles and tendons of the calf were largely necrotic.

Fig. 8. Case VII. Fracture of tibia and fibula with extensive gas infiltration of soft tissues.

X-ray therapy was given to the stump and up to the lower abdomen on the day of amputation, twice on the following day, and once daily for two days thereafter.

As will be seen from Figure 7, the temperature dropped further following amputation. Drainage

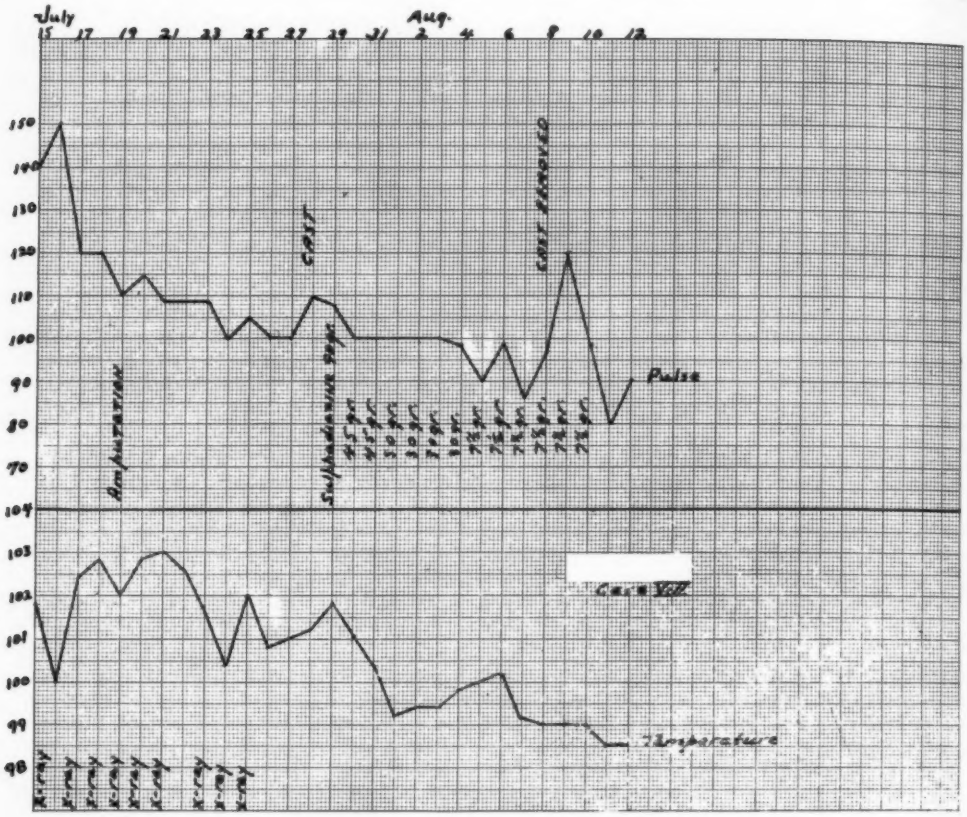

Fig. 9. Case VIII. Pulse and temperature chart.

was profuse both from the lateral incision and from the stump. By April 24, or thirteen days after amputation and ten days after discontinuance of x-ray therapy, the edema and boggy induration above the site of amputation had completely subsided and the calf region was free from crepitus. A culture from pus at this time showed a small quantity of gas. The patient's general condition was good.

Four cultures taken after April 7 and prior to amputation failed to produce gas in broth under anaerobic conditions. One culture injected into a rabbit on April 9 produced gas in small quantity. A culture from the amputated foot obtained deep in the tissues produced gas after thirty-six to forty-eight hours.

The patient was discharged on April 29, using crutches. A later wound culture was not obtained before discharge.

CASE VIII: E. N., a white male of 59 years, was admitted to the Swedish Hospital (by Dr. Darrell Leavitt) on July 16, 1942. He had been severely injured in a bus accident on July 14 and had been taken to an outlying hospital. When we first saw the patient he was in severe shock, markedly dehydrated and partially irrational; the temperature was 102; pulse 140 and thready. There was a severe secondary anemia from hemorrhage and the toxemia of disease; the red blood count was 2,580,000, with 8 gm. hemoglobin, and the white blood count was 14,800.

The right lower extremity was in a Thomas splint. The right foot was cold and colorless, and no pulsation could be elicited over the dorsalis pedis or posterior tibial arteries. There was a laceration over the medial aspect of the leg at the mid-point and a deep laceration over the lower third of the medial aspect of the thigh. Each of these was approximately 6 cm. in length. Crepitus extended from the laceration on the leg to just above the laceration of the thigh. The knee joint was ballooned by a large quantity of entrapped gas, and when pressure was applied over the joint a large amount of gas escaped from the wound in the thigh.

All that we could learn of the treatment prior to admission to the Swedish Hospital was that transfusions had been given, and that sulfathiazole had been applied to the wound locally.

X-ray therapy was given, on the night of admission, to the entire lower extremity through six contiguous portals, extending above Poupart's ligament. The patient also received 500 c.c. of blood and 250 c.c. of plasma, as well as glucose intravenously. Gas bacillus antitoxin (100,000 units) was ordered by Doctor Leavitt to be given intravenously. After 50,000 units had been administered, the patient had a severe serum reaction with a chill which lasted continuously for one and a half hours, despite adrenalin and supportive measures. In his critical condition this was a severe strain on his overburdened body economy.

On the morning after admission the temperature was 98.6° and pulse 98. The general condition was somewhat improved. X-ray therapy was given twice daily for the next three days, the entire extremity from the lower abdominal quadrant downward being irradiated through six portals. During this time the patient received two additional transfusions, glucose intravenously, and more antitoxin (10,000 units). The pulse remained around 100 to 120, but the temperature rose from its first drop to its former level of 102–103°. There was a progressive gangrene of the foot and leg, which by the third day were black. The amount of gas in the tissues was so abundant that when it spontaneously escaped through the wounds it could be heard across the room. The toxemia was such that the patient was partially comatose.

Because of the progressive gangrene from arterial occlusion, amputation was decided upon on the fourth day. The improvement in the strength of the pulse (Fig. 9) gave some hope that the patient could weather the procedure. A mid-thigh guillotine amputation was done. Two transfusions of 500 c.c. each were given on the day of amputation. X-ray therapy was also given twice on this day to the remaining thigh, the region of the hip, and lower abdominal quadrant. Irradiation was continued once daily on the sixth and seventh days. On the eighth day an x-ray examination of the hip (Fig. 10) showed a fracture of the upper femur surrounded by a large amount of gas deep within the thigh. This was drained, and x-ray therapy was continued daily through the tenth day. Although the fever persisted (101–102°), the pulse had greatly improved and remained around 100. The general condition was much better and the patient could take nourishment by mouth. On the thirteenth day the stump was placed in a cast to secure complete immobilization and chemotherapy was begun—90 gr. of sulfadiazine the thirteenth day and 45 gr. for twelve days thereafter. The temperature under this management gradually came down to around 100°. When the cast was removed, on the twenty-fourth day, there were still considerable infection and necrosis in the soft tissues of the stump, but no evidence of gas. Thereafter the temperature remained normal.

A dissection of the amputated extremity showed a complete thrombosis of the femoral artery, beginning about 4 cm. below the level of amputation. A culture from the pus obtained at amputation produced abundant gas under anaerobic conditions.

Fig. 10. Case VIII. Entrapped gas abscess above level of amputation and around site of fracture.

In all, the patient had received 73,200 units of gas bacillus antitoxin in the first nine days, 4,000 c.c. of blood in the first eight days, 250 c.c. of plasma on the first and sixth days, in addition to glucose intravenously to combat dehydration. X-ray therapy was given over the first ten days: on the night of admission, twice every twenty-four hours for four days thereafter, and once daily on the sixth, eighth, ninth and tenth days. Sulfadiazine was used from the fourteenth to the twenty-sixth day to combat the residual infection after x-ray therapy had been discontinued.

CASE IX: W. J. E., white male 35 years of age, was injured Sept. 22, 1943, at 1 P.M. in the shipyards, having cut himself with a piece of new clean metal over the first interphalangeal joint of the right index finger. He applied a dressing from a first-aid kit which, according to his report, was standing open in the room. Since the bleeding continued, he had a better bandage applied by the nurse. At 4 P.M., he noticed a swelling over the hand and a throbbing pain. He was referred by the attending nurse to a local physician, who recognized the condition as beginning gas infection and sent the patient to Dr. William B. Hutchinson.

The patient was seen about 5:30 P.M. by Doctor

TABLE I: TREATMENT AND RESULTS IN NINE CASES OF GAS GANGRENE

Case	Interval Between Injury and Beginning of X-Ray Therapy	No. of X-Ray Treatments and Total Period of X-Ray Therapy	Maximum No. of Fields and Size	Kilovoltage and Filtration	Dose* per Field per Treatment and Total per Field	Antitoxin	Chemotherapy†	Surgery	Result
I	24 hr.	Twice daily 3 days Once 5th day (Total 5 days)	4 Entire arm	130, 4 mm. Al 200, 0.5 mm. Cu + 1.0 mm. Al	50 to 100 r Total 150 to 575 r	190,000 u.	0	Débridement prior to x-ray therapy	Recovery No amputation
II	40 hr.	Three times first day Twice 2d day Once 3d day (Total 3 days)	8 Entire arm and adjacent chest wall	130, 4 mm. Al 200, 0.5 mm. Cu + 1.0 mm. Al	50 to 100 r Total 50 to 450 r	110,000 u.	0	Amputation for traumatic gangrene 14 days after injury	Recovery Amputation for traumatic gangrene
III	5½ days	Two or 3 daily 5 days Once daily 8 days (Total 13 days)	7 15 cm. diameter	120, 0.25 mm. Cu + 2.0 mm. Al	50 to 150 r Total 225 to 1275 r	90,000 u.	Sulfanilamide and sulfathiazole prior to entry. Sulfathiazole to wound on 41st day, after gas culture was negative	Débridement and realignment of fracture on 16th day. Positive gas cultures were still present; toxic phase past	Recovery No amputation
IV	9 days	Twice daily 5 days Once daily 2 days (Total 7 days)	5 15 cm. diameter to 10×15 cm.	120, 0.25 mm. Cu + 2.0 mm. Al	50 r Total 50 to 500 r	0	Sulfanilamide for 9 days prior to entry. Begun again on 3d day and continued through 16 days	Amputation for traumatic gangrene on 9th day. Toxic phase past; gas still present	Recovery Amputation for traumatic gangrene
V	4 days	Twice daily 3 days Once daily 4 days (Total 10 days)	6 15 × 15 cm.	200, 1.0 mm. Cu + 1.0 mm. Al	75 to 150 r Total 150 to 725 r	10,000 u.	Sulfanilamide begun 9th day, 4 days after gas cultures were negative	Drainage of abscesses under scalp after gas infection was controlled and cultures were negative	Recovery
VI	19 days	Once on admission Twice daily 6 days Once daily 5 days (Total 12 days)	5 8 × 12 cm. to 15 × 12 cm.	200, 2.0 mm. Cu + 1.0 mm. Al 120, 0.25 mm. Cu + 2.0 mm. Al	75 to 125 r Total 170 to 1500 r	0	Sulfathiazole for 8 days prior to entry; none thereafter	Débridement on 27th day; smoldering gas abscess still present. Reconstructive surgery, begun 5 months after injury, unsuccessful. Amputation of foot to obtain functional result, 18 months after injury	Recovery Amputation of foot 18 months later to obtain functional extremity
VII	6 days	Twice daily 4 days Once day of amp. Twice following day Once daily 2 days (Total 8 days)	8 16 × 12 cm.	200, 2.0 mm. Cu + 1.0 mm. Al	50 to 75 r Total 550 to 825 r	0	Sulfathiazole and sulfadiazine over period of 20 days prior to x-ray therapy and for 2 days after x-ray therapy was begun	Amputation of foot for traumatic gangrene and drainage of gas abscesses of leg, 5 days after beginning x-ray therapy and after the acute toxemia had subsided	Recovery Amputation for traumatic gangrene
VIII	2 days	Once on admission Twice daily 4 days Once on 6th, 8th, 9th, and 10th days (Total 10 days)	7 10 × 20 cm. to 20 × 20 cm.	200, 2.0 mm. Cu + 1.0 mm. Al 120, 0.25 mm. Cu + 2.0 mm. Al	75 to 115 r Total 150 to 740 r	73,200 u.	Sulfathiazole to wound at time of injury. Sulfadiazine orally on 14th day, 9 days after x-ray therapy had been discontinued	Mid-thigh amputation for traumatic gangrene of leg and lower thigh on 4th day. Drainage of gas abscess upper thigh on 8th day	Recovery Amputation for traumatic gangrene
IX	6¼ hr.	Three times first day Twice daily 2 days Once daily 2 days (Total 5 days)	6 Entire arm and adjacent chest wall	200, 2.0 mm. Cu + 1.0 mm. Al	100 to 150 r Total 1000 r	0		Wound cleaned up with green soap	Recovery. Patient back to work in 6 days

* Dose measured with back-scatter.
Doses are stated in text when known. Days not otherwise stated refer to time after admission to the Swedish Hospital.

Hutchinson. At that time crepitation was noticed reaching somewhat beyond the wrist joint. The wound itself was represented only by a small clean cut about 2 cm. in length. There was no discharge of gas through the wound, which appeared perfectly clean. The hand was cleansed with green soap and water and a new dressing was applied. At 6:30 P.M., the surgeon noticed progression of the crepitation to include the lower third of the forearm. The x-ray picture taken at that time (Fig. 11) showed gas over the dorsum of the metacarpal area.

The patient was seen by us at 7:30 P.M. At that time there was a severe edema, with a throbbing pain over the dorsum of the hand and crepitation extending along the entire forearm up to the elbow joint. The general condition was excellent. Temperature was 98.2°.

On Sept. 24, the patient again received 150 r to each of the three lower fields in the morning and 100 r to each field in the afternoon. On Sept. 25, 100 r were applied to each of the three lower fields, and on Sept. 26 only the two lower fields, including the hand and about one-third of the forearm, were treated with 100 r each.

During the entire treatment time, the patient was in excellent condition, with good appetite and no clinical sign of intoxication. His temperature remained normal throughout. The crepitation disappeared within the next three days following therapy and the patient left the hospital.

Although we have no bacteriological proof in this case, the clinical diagnosis of a gas bacillus infection was made unanimously by three orthopedic surgeons and the radiologist. A culture could not be obtained because no gas was discharged from the wound, and in order to obtain material for bacteriological investigation it would have been necessary to puncture the normal skin over the dorsum of hand. We hesitated to do this because of the possibility of a secondary infection developing in this area. We believe that this case represents Kelly's pretoxic stage. This is the ideal stage for radiation therapy and the uneventful recovery in this case is probably attributable to the early application of x-rays. No additional treatment of any kind, serum or sulfa drugs, had been given. The infection, in all likelihood, originated in the patient's own skin and should be considered similar to the infection following hypodermic injection, since there was no major injury. This patient probably received more x-ray therapy than was necessary; in all likelihood, the last two treatment periods might have been omitted. He was, however, back at work one week after the injury.

Fig. 11. Case IX. Small cut over dorsum of finger. Crepitation over dorsum of hand, visible gas, six hours after injury.

Roentgen therapy was started at 7:45 P.M. The area was divided into six fields from the hand up to the shoulder, the last portal including a portion of the chest wall. Each field received 100 r with 200 kv., 2 mm. copper, 1 mm. aluminum, at 70 cm. distance. Five hours later, at 12:15 A.M., the upper limit of the crepitation had not changed. There was less pain over the dorsum of the hand. At that time a second treatment series was administered, five fields being treated, up to the anterior axillary line but with omission of the chest wall. Again 100 r were applied to each field.

On Sept. 23, at 9:15 A.M., the patient's general condition was still excellent. The throbbing pain in the hand had disappeared. There was less crepitation in the forearm and less swelling over the dorsum of the hand; the crepitation over the hand was about the same as on the previous evening. The same five fields were treated with 100 r each. At 4:30 P.M., there was still some discomfort over the dorsum of hand but pain could be elicited only by palpation. There was still crepitation in this area, but the crepitation over the forearm had regressed considerably and in the upper portion had completely disappeared. At this time the three lower fields, including the hand and forearm up to the elbow, received 150 r each, while the two upper fields, including the upper arm, received 100 r each. The blood count on Sept. 23, 1943, was 13,600 white cells with 64 neutrophils and 32 lymphocytes.

DISCUSSION

An analysis of the foregoing cases brings out certain pertinent questions and conclusions:

1. The group includes all our cases of traumatic gas bacillus infection which have been treated by x-rays. The mortality thus far is zero, but we do not expect that

this record can be maintained. A mortality of 11.2 per cent in 125 cases, as reported by Kelly, still represents a large saving in lives over reports prior to the use of x-ray therapy in this disease.

2. In all the cases with the exception of II and IX, bacteriologic proof was obtained that the infection was due to a gas-producing organism. In 7 instances infection was fulminating, the exceptions being Case VI, which was of the so-called "gas abscess" type with less tendency to rapid spread, and Case IX, which was treated in a very early stage.

3. Two patients with post-traumatic gas bacillus infection of an extremity in which there was no traumatic vascular occlusion accompanied by gangrene (Cases I and III) recovered without amputation. In another similar case (Case VI) amputation was done eighteen months after treatment because it was found impossible to reconstruct a serviceable foot. In 4 cases (II, IV, VII, and VIII) amputation was necessary because of traumatic gangrene of an extremity. In 3 of these cases x-ray therapy unquestionably served to limit the infection, reduce the toxemia, and permit amputation at a time when it could be withstood with greater likelihood of survival. In Case VIII, which was the most critical of this group, we believe that, although the x-ray did contribute something to the general condition of the patient and help to lessen the toxemia, the extent of traumatic gangrene was such that further postponement of amputation would have been fatal. A subsequent gas abscess above the line of amputation necessitated further drainage. Spread beyond this point was, however, controlled.

One patient (Case V), with severe infection involving the scalp and face, made a rapid recovery in five days. Surgery after that date served to drain abscesses due to secondary invading bacteria which had accumulated under the scalp.

4. Four patients (Cases I, II, III, and VIII) received gas bacillus antitoxin in therapeutic amounts. One (Case V) received only 10,000 units, which was sufficient only to cause a severe serum reaction. Three cases (Cases IV, VI, VII) received no antitoxin. Kelly has reported a group of 46 cases treated with x-ray and no serum, with a mortality of 4.3 per cent, and concludes that the low mortality when both are employed is due to the radiation and not to the use of serum. We agree with this point of view and have not urged our surgical colleagues with whom we have collaborated to use antitoxin. It is our belief that the patients who received antitoxin would have recovered as well without it. Kelly's reports and our own 3 cases in which no antitoxin was given lead us to this conclusion. Our critics (3) hold that, "in view of the generally accepted efficacy of serum in the treatment of gas bacillus infection, it would be difficult to say whether the recovery of four patients was due to roentgen therapy or to serum therapy." The answer would appear to be found in the mortality figures given by Kelly (1): 35 to 50 per cent when serum therapy is combined with surgery, 4.3 per cent with x-ray therapy and surgery without serum.

5. Three patients received no chemotherapy, two of them probably because they were treated before the sulfonamides came into use. Two patients (Cases IV and VI) received sulfonamides for nine days prior to admission; one (Case VII) received interrupted doses averaging about 35 grains daily for twenty days before we saw him. In one (Case VIII) sulfathiazole was applied directly to the wound at the time of injury.

In two patients (Cases III and V) chemotherapy was used effectively for the secondary infection after the gas bacillus infection had been controlled and x-ray therapy had been discontinued. In one case (IV) sporadic chemotherapy was begun three days after x-ray therapy was started and continued through sixteen days. In one case (VIII) chemotherapy was used after amputation and subsidence of the acute toxic phase of the infection; a smoldering gas infection was present when it was begun but no gas was present twelve days

later, when the stump was examined following the removal of a cast, which had been applied to secure immobilization to control the residual infection.

In none of these cases is there evidence that chemotherapy had a place in controlling the progression of the gas bacillus infection. When used to combat the secondary bacterial invasion after the spread of gas infection had been brought under control, it seems to have produced good results in Cases III, V, and VIII.

6. Certain of these cases demonstrate the ability of the patient to deal with gas bacillus infection if he can be helped over the initial acute toxic phase. This is well demonstrated in Case III, in which x-ray therapy was discontinued on the thirteenth day, when crepitus was absent, though the culture still produced gas. The general condition of the patient by this time was greatly improved, though negative cultures for gas were not obtained until the fortieth day. In Case VI x-ray therapy was discontinued on the twelfth day, but it was not until thirty-two days later that cultures became negative for gas-producing organisms.

The civilian surgeon, faced with a single case of traumatic gas bacillus infection, or the military surgeon with a ward full of its victims, is confronted by a menace to the life and future welfare of his patients. Well directed roentgen therapy has proved its efficacy in saving both lives and limbs. The thoughtful and diligent combination of surgery and x-ray therapy can produce results not heretofore obtained by any approach to this most severe complication of traumatic wounds.

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REFERENCES

1. KELLY, J. R., AND DOWELL, D. A.: Twelve-Year Review of X-Ray Therapy of Gas Gangrene. Radiology **37:** 421–438, October 1941. Roentgen Treatment of Infections. Chicago, Year Book Publishers, 1942.
2. MERRITT, E. A., DEN, A. J., AND WILCOX, U. V.: Effects of Radiation Therapy in Clostridium Infection in Sheep. Radiology **43:** 325–329, October 1944.
3. Editorial. J. A. M. A. **118:** 230, Jan. 17, 1942.
4. CANTRIL, S.: Roentgenotherapy of Gas Bacillus Infection. Radiation Therapy (supplement to Staff Journal of the Swedish Hospital), No. 2, pp. 95–103, May 1941.

Clinical and Roentgenological Study of the Effects of Hormonal Therapy on Bone Growth[1]

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THE EFFECT OF hormonal therapy on growth in children has been under investigation in the Endocrine Clinic of the Beth Israel Hospital for the past eight years. Growth rate observations were made not only on children treated for growth deficiency, but also on those showing hypogenitalism, cryptorchidism, pseudo-Fröhlich's syndrome, obesity, and mental retardation.

Clinical observations of growth and of genital and somatic development were conducted. Prior to, during, and after therapy, routine roentgen studies of the skull, sella turcica, and long bones were made at regular intervals. The skeletal age was estimated by the epiphyseal development of the distal ends of the radius, ulna, metacarpals, and the phalanges of the hands, by the presence of the centers of ossification, and the number of carpal bones. The progress of skeletal development was judged in accordance with the standards of Todd (18). The degree of mineralization was estimated by those standards established for the study of osseous structure.

These studies were carried out on a group of 81 children, of whom 65 were clinic patients and 16 were private patients. The therapeutic agents employed were: thyroid substance[2] in 18 children, anterior pituitary extracts (growth hormones)[3] in 26 children, chorionic gonadotropin (extract of human pregnancy urine)[4] in 19 children, and male sex hormone (testosterone preparations)[5] in 18 children (Table I). Our clinical observations of this and other groups of children have been reported in previous communications (4). This presentation is concerned with the effect of the various hormones on skeletal growth, bone density, and epiphyseal union.

A considerable amount of experimental work in this field, on mice, rats, and guinea-pigs, has been carried out by well known investigators (3, 6–10, 13–17). While there is no complete accord on the subject, the majority of investigators agree that thyroid substance and anterior pituitary growth hormones stimulate skeletal growth and maturation. If treatment is carried out over prolonged periods of time, accelerated bone aging and cessation of growth may occur. These findings apply, also, to the testosterone preparations and in a lesser degree to chorionic gonadotropin. Experimental observations in animals, however, and clinical results in man do not always coincide. The size of laboratory animals, their brief span of life, the dosage of the hormones used, and the duration of the therapy are generally out of proportion to the therapeutic doses administered to children over comparatively short periods.

THYROID THERAPY

True cretinism and hypothyroidism are frequently characterized by the delayed appearance of ossification centers, subnormal bone density, chondro-epiphysitis, striations of the diaphysis, and other evidences of metabolic disturbances and deficiencies. In many patients, x-ray examination fails to confirm the presence of hypothyroidism. The diagnosis, however, may depend on other laboratory and clin-

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[2] Desiccated thyroid substance, U.S.P.

[3] The anterior pituitary growth extracts used were as follows: Growth Complex (Ayerst, McKenna & Harrison); Phyone (Wilson Lab.); Antuitrin G (Parke, Davis & Co.).

[4] The chorionic gonadotropin (A.P.L.) used in our series of cases was supplied through the courtesy of Ayerst, McKenna & Harrison.

[5] The testosterone preparations (Oreton, Oreton M., and testosterone pellets) were supplied through the courtesy of Dr. Max Gilbert of the Schering Corporation of Bloomfield, N. J.

TABLE I: EFFECTS OF HORMONE THERAPY ON GROWTH RATE

Therapy	No. Cases	Ages in Years	Average Dosage	Duration of Therapy	Growth Rate
Thyroid substance	18	4 to 16	1/4 to 3 gr. daily	4 mo. to 7 yr.	Increased in 8 cases Maintained in 10 cases
Anterior pituitary growth extract	26	6 to 17	1 to 2 c.c. 2 to 3 times per week	2 to 24 mo.	Increased in 8 cases Maintained in 18 cases
Chorionic gonadotropin	19	3 1/2 to 17	500 I.U. 2 to 3 times per week	2 to 24 mo.	Increased in 17 cases Maintained in 2 cases
Testosterone compounds Orally Parenterally Implantation	18	8 to 18	10 mg. twice daily 10 to 25 mg. twice weekly 300 to 500-mg. pellets every 6 months	2 mo. to 4 yr.	Increased in 16 cases Maintained in 2 cases

TABLE II: EFFECT OF HORMONAL THERAPY ON SKELETAL GROWTH AND STRUCTURAL DENSITY

	Thyroid Substance 18 Cases		Growth Hormone 26 Cases		Chorionic Gonadotropin 19 Cases		Testosterone Preparations 18 Cases	
	Before Therapy	After Therapy	Before Therapy	After Therapy	Before Therapy	After Therapy	Before Therapy	After Therapy
Normal epiphyseal union and skeletal structural density	8	13	7	11	14	15	7	8
Delayed epiphyseal union	6	5	14	11	4	2	9	8
Accelerated epiphyseal union	0	0	3	4	0	0	0	0
Decreased structural density (degree of rarefaction)	4	0	2	0	1	0	2	0
Excessive structural density (degree of radiopacity)	0	0	0	0	0	2	0	2

ical evidence, such as a low basal metabolic rate, elevated blood cholesterol, pallid dry skin, coarse hair, pudgy hands and feet, and mental sluggishness and retardation.

The group of patients studied by us consisted of 18 children who presented clinical and laboratory features of hypothyroidism. The x-ray evidences, when present, were deficient bone density and maturation. Normal epiphyseal union and skeletal structural density were present in 8 children; in 6 there was delayed epiphyseal union, and in 3 of these decreased bone density was also observed; decreased structural density without delay in epiphyseal union was present in 4 children. Following therapy with thyroid substance, there was an improvement in bone density in all cases, but the delay in epiphyseal union was still present in 5 out of 6 subjects (Table II).

CASE I: V. L., white female, age 7, height 40 in., weight 44 lb., was admitted to the Endocrine Clinic because of mental retardation and clinical symptoms of hypothyroidism, including stunted growth, pudgy hands and extremities, and coarse hair.

The blood Wassermann reaction was negative. Blood chemistry studies showed, for 100 c.c. of blood: calcium, 14.6 mg.; phosphorus, 5.2 mg.; cholesterol, 200 to 333.2 mg. The basal metabolic rate ranged between −30 and −17. Roentgen examination of the long bones revealed a delay in the appearance of the centers of ossification; the ulnar epiphyses were absent, there was a delay in epiphyseal union, and only 4 metacarpal bones were present. There was also a decrease in bone density and scorings were present on the radius. The estimated skeletal age was approximately 3 years 3 months, a delay of about three and a half years (Fig. 1).

Thyroid therapy was carried out at irregular intervals for three and a half years. The dosage administered varied from 1/4 to 1/2 gr. of thyroid substance twice daily. Throughout this period roentgen studies of the long bones were made at intervals and gradual improvement in osseous structural density was observed.

Roentgen studies at the end of the three-and-a-half-year period showed the centers of ossification to be normal; the epiphyseal development was slightly advanced, mineralization was moderate, and the scorings on the radius were present. The skeletal age was approximately 11 years 3 months, whereas the actual age was 10 1/2 years (Fig. 2). Clinically the progress of growth was satisfactory. During the period of treatment, the child grew 9 1/2 in. Although the physical development progressed satisfactorily, the mental retardation was not noticeably affected.

GROWTH HORMONE THERAPY

Twenty-six children whose growth was stunted were treated with anterior pituitary growth extracts. Before therapy was begun, the majority of these children showed retarded bone development for their age period. Delayed epiphyseal union, delayed appearance of the centers of ossification, and subnormal bone density were revealed by x-ray. In 3 children a premature advance in the size and density of the bones was observed, but the epiphyseal lines remained open.

During the course of therapy and subsequently, skeletal growth and development proceeded normally in 11 children. In another group of 11 children the initial delay in epiphyseal union persisted after the completion of therapy. In the 4 remaining members of this group there was evidence of rapid bone maturation and epiphyseal closure. In 3 of these children, as mentioned, a premature advance in the size and density of the bones was observed before therapy was instituted (Table II).

Anterior pituitary growth extract[6] was administered in doses of 1 to 2 c.c. two to three times a week for periods ranging from two months to two years, with intervals of rest periods in the protracted cases, which varied from four to six weeks every three or four months. No appreciable difference was noted in the various commercial preparations employed.

Eight of this group of 26 children showed an acceleration in bone growth rate. In the remaining 18 children anterior pituitary growth extract therapy was ineffectual. Of the 8 patients responding favorably, 5, whose ages ranged from 10 1/2 to 14 years, showed a moderate response. Three children in the age range of 15 1/2 to 17 years showed a good response. A growth spurt may occur in adolescents, however, without the employment of any therapy.

Our findings are in comparative harmony with those of Silberberg and Silberberg (16), who carried out extensive experiments for several years on mice and guinea-pigs. These animals were injected with 1 c.c. of anterior pituitary growth hormone[7] extracts daily for periods ranging from four days to six months. The initial effect was a stimulation of growth of the cartilage at the epiphyseal line. With further injections the epiphyseal lines became narrow and calcified and premature bone aging became apparent. A certain percentage of treated animals did not show this tendency to accelerated calcification.

If any response at all to the growth extract therapy was achieved in our children, it seemed to be only a temporary stimulation of the growth of epiphyseal cartilage. This may have been due to various factors: (1) The amount of anterior pituitary growth extract administered in proportion to body weight was much smaller than that administered to guinea-pigs. (2) The guinea-pigs received treatment at more frequent intervals—*i.e.*, daily—than the patients. Therefore, the amount, duration, and intensity of therapy which our patients received may have been insufficient to produce any marked skeletal changes. The response to hormonal medication may vary in individuals, as it does in animals.

[6] When our work with growth hormones began some eight years ago, the only preparations available were the crude extracts which were unstandardized, and it is therefore difficult to evaluate their exact strength. For approximately five years, however, we have employed the standardized material of Ayerst, McKenna, and Harrison, each cubic centimeter of which was stated to contain 10 R.U. (Collip units). In the last three years the units per cubic centimeter were raised to 100 R.U. (Collip units). While during this development there were apparent increases in the strength of the material used, the effect on bone growth and maturation did not seem to be materially different with the variations in concentration. Twenty-one patients were treated with Growth Complex (Ayerst), 3 with Phyone (Wilson), and 2 with Antuitrin "G" (Parke, Davis).

[7] Antuitrin "G" (Parke, Davis) was employed.

Figs. 1 and 2. Case I: Results of thyroid therapy.

Fig. 1 (above). Age 7 years. Height 40 in. Weight 44 lb. Skeletal age 3 years 3 months. Delayed appearance of centers of ossification; absence of ulnar epiphyses; delayed epiphyseal development. Only 4 metacarpal bones. Mineralization light. Scorings present on radius.

Fig. 2 (below). Age 10 1/2 years. Height 57 1/2 in. Weight 106 lb. Skeletal age 11 years 3 months. Normal centers of ossification. Epiphyseal development slightly advanced. Mineralization moderate. Scorings present on radius.

The favorable response in the few cases mentioned may have been due to the influence of the anterior pituitary growth extract or to the tendency to a sudden acceleration of growth at adolescence.

CASE II: H. F., white male, age 17, was admitted to the Endocrine Clinic for growth retardation on Aug. 22, 1940. On admission his height was 60 1/2 in., weight 82 lb. His physical development was childish and he was shy and reticent. Roentgen examination of the hands and wrists showed a slight degree of mineralization as evidenced by subnormal structural density and apparent narrowing of the cortices of the phalanges and a delay in epiphyseal union. Estimation of the delay in epiphyseal union was based on the open epiphyses of the metacarpals and phalanges. The approximate skeletal age was 14 years 9 months (Fig. 3).

Anterior pituitary growth extract[8] was administered over a period of eight months, a total of 220 c.c. being given during this time. At the completion of therapy there was an increase of 1 1/2 in. in height. Growth continued and at the end of a year the total increase in height was 4 in., as compared to 3/4 in., during the year preceding therapy. The voice deepened, genital development was accelerated and there was increased assurance.

Roentgen studies carried out a year and a half after the initiation of therapy showed an elongation of the vertical axis of the metacarpals and phalanges; retardation of epiphyseal union still persisted; there was no increase in bone density (Fig. 4). The skeletal age was slightly advanced, to 15 years 3 months.

This case illustrates a favorable response to anterior pituitary growth extract. The coincidence of treatment and adolescence must, however, be considered.

CHORIONIC GONADOTROPIN THERAPY

In our earlier publication (1942) we reported growth observations on 50 children treated with chorionic gonadotropin (4). Sixty-two per cent of these showed an increase in growth rate and 38 per cent maintained their original growth rate. There was an increase in the genital development in all of the children thus treated. Detailed roentgen studies were carried out on 19 children in this group. X-ray studies of the long bones were made with special reference to bone density, size, and degree of maturation, and particularly epiphyseal union, whether it was retarded, normal, or advanced for this age period. The average age of the children in this group was 12 years, the youngest being 3 1/2 and the oldest 17 years of age.

The average duration of therapy was seven months, the range being from two to twenty-four months. The average total amount of chorionic gonadotropin administered to a patient was 33,000 I.U. The variations were from 9,000 to 131,000 R.U. From 200 to 500 I.U. were administered two or three times a week.

The initial roentgen studies showed normal bone density and development in 14 children. Delayed epiphyseal union with a mild degree of decreased bone density was observed in 4 children. Decreased structural density without a delay in epiphyseal union was present in one instance. Following therapy there was an increase in bone length without acceleration of epiphyseal union in 15 cases. Delay in epiphyseal union persisted in 2 out of 4 children and acceleration of bone maturation was present in the other 2. These 2 children were treated for longer periods than any others in this group. One, aged 3 1/2, was treated for twenty-three months, the other, aged 4, for twenty-four months. The total amount of chorionic gonadotropin was correspondingly large, 93,500 I.U. being given to one child and 131,000 I.U. to the other. In spite of the advanced state of bone growth and increased structural density, the epiphyses have remained ununited, and clinically the children continued to show accelerated growth two years after cessation of therapy. The unusually prolonged period of therapy and the large amount of hormone used in these 2 cases were rather exceptional and were employed in an effort to correct an extreme degree of hypogenitalism and cryptorchidism (Tables I and II).

The majority of the children in this group showed normal skeletal growth and development with a tendency to accelerated lengthening of the long bones. The roentgen findings were borne out by the clinical progress. In the majority of cases there was a tendency to a spurt in growth rate

[8] Growth Complex (Ayerst), 100 R.U. per c.c.

Figs. 3 and 4. Case II: Results of growth hormone therapy.
Fig. 3 (above). Age 17 years. Height 60 1/2 in. Weight 82 lb. Skeletal age 14 years 9 months. Retarded epiphyseal union. Mineralization light. No scorings on radius.
Fig. 4 (below). Age 18 1/2 years. Height 64 1/2 in. Weight 112 1/2 lb. Skeletal age 15 years 3 months. Note increase in vertical axis of metacarpals and phalanges. No advance in epiphyseal union and no increase in bone density. No scorings on radius.

Fig. 5. Case III: Age 3 1/2 years. Height 35 in. Weight 38 lb. Skeletal age 3 to 4 years. Normal centers of ossification. Mineralization light. No scorings on radius.

either during the course of therapy or within a year after cessation of therapy.

CASE III: R. L., male, age 3 1/2 years, height 35 in., weight 38 lb., was admitted to the Endocrine Clinic on Oct. 10, 1937, showing bilateral cryptorchidism and hypogenitalism, mental retardation, and a speech defect. The roentgen studies of the long bones revealed the centers of ossification to be normal, but there was a light degree of mineralization (Fig. 5).

Therapy with chorionic gonadotropin was carried out over a period of two years, with varying intervals of rest. The total amount of chorionic gonadotropin administered was 93,500 I.U. X-ray examination of the hands and wrists at the completion of therapy showed rapid bone growth and maturation. The size and density of the bones were about a year and a half in advance of the actual age, which was then 5 1/2 years (Fig. 6). At this time the child's height was 45 1/2 in. and his weight was 41 lb. The therapy was therefore discontinued for two years. Chorionic gonadotropin therapy also stimulated genital development and descent of the testes. During the four-year period of observation and treatment the patient grew 18 1/2 in., which may be considered a marked spurt in somatic growth. However, because the withdrawal of therapy was followed by a regression in the genital development and the retraction of the testes into the inguinal canal, it was decided to administer a short course of testosterone therapy in order to improve the weight, genital status, and general vitality, which were below par. Accordingly, testosterone propionate was given in doses of 10 to 25 mg. once or twice a week, a total of 700 mg. being administered over a period of seven months. Clinically, a gain in weight and improvement in vitality and genital development were observed. There was a further increase in skeletal growth and epiphyseal development as revealed by the x-ray. All the carpal bones were present and well developed, and no tendency to premature epiphyseal union was apparent. The skeletal age was about 11 years, an advance of a year and a half over the actual age (Fig. 7). At this time the height was 56 3/4 in., the weight 69 lb. The boy became mentally more alert and sociable, and there was some improvement in his speech.

In this case, intensive and prolonged chorionic gonadotropin therapy stimulated

Fig. 6. Case III, following chorionic gonadotropin therapy. Age 5 1/2 years. Height 45 1/2 in. Weight 41 lb. Skeletal age about 7 years. Note rapid advance in appearance of ossification centers and number of carpal bones. Mineralization heavy. No scorings on radius.

somatic and genital growth and development. Skeletal growth was rapid and progressed in advance of the actual age. During the two years following cessation of therapy, body and bone growth proceeded at a favorable rate. This progress also continued during and following testosterone therapy. Five and one-half years after the original roentgen studies were made, bone growth, structural density, and development were about a year and a half in advance of the chronological age. When last observed, the child continued to grow at a satisfactory rate.

TESTOSTERONE THERAPY

Roentgen studies were carried out on 18 children who received testosterone therapy for growth deficiency and hypogenitalism. Normal epiphyseal union and skeletal structural density were observed in 7 children. There was a delay in epiphyseal union in 9 children; in 2 of these there was also evidence of decreased structural density, and 2 others of this group showed a decrease in bone density without a delay in epiphyseal union (Table II).

The children were treated for periods ranging from two and a half to fourteen months, each receiving a total of 300 to 1,900 mg. of testosterone propionate, with the exception of one eunuchoid boy, aged 18, who was treated over a period of four years and received a total of 5,050 mg. of testosterone propionate by injection, methyl testosterone orally, and implanted testosterone.

Testosterone therapy was administered in the following manner: by injection, 10 to 25 mg. testosterone propionate twice weekly; by implantation, 300 to 500 mg. of testosterone at each implantation; orally, methyl testosterone tablets, 10 mg. twice daily. The clinical response in most

Fig. 7. Case III, following testosterone therapy. Age 9 1/2 years. Height 56 3/4 in. Weight 69 lb. Skeletal age about 11 years. Note further progress in skeletal growth and epiphyseal development. There is no tendency to premature epiphyseal union. Mineralization heavy. No scorings on radius.

patients was extremely satisfactory. There was an appreciable increase in the growth rate and genital and muscular development, with a deepening of the voice and an increase in vitality and assurance.

The roentgen studies failed to reveal any marked changes in the majority of cases. Eight children showed normal progress for their age. Eight others showed a persistent delay in epiphyseal union. The 2 remaining children of this group showed a tendency to excessive structural bone density. Deficient mineralization observed before the therapy was initiated was in most cases corrected on completion of treatment. In one of these patients the accelerated bone growth and maturation were previously produced by prolonged therapy with chorionic gonadotropin (Case III). No tendency to premature epiphyseal union was noted, however, and clinical and skeletal growth continued. A moderate increase in structural density was shown in another child, who received a total of only 525 mg. of testosterone.

One eunuchoid patient who received 5,050 mg. of testosterone orally, by injection, and by implantation, over a period of four years failed to show any increase in structural bone density. At the age of 22 the epiphyses of this patient still remained ununited. Another eunuchoid boy, aged 18, received 1,475 mg. of testosterone in various forms over a period of nine months without any effect on epiphyseal union.

On the whole, increased bone density and maturation were noted in only 2 children out of the 18 treated. In the majority there was only an increase in the vertical axis of the long bones without a material hastening of epiphyseal union or undue increase in structural density.

Our clinical findings correspond to those reported in experimental studies. Rubinstein and Solomon (13) found that small doses of testosterone propionate administered to animals caused an initial spurt in growth. Larger amounts caused calcification and premature aging of epiphyseal cartilage with cessation of growth, as noted also by Silberberg and Silberberg (16 *e*, *f*). The amounts of testosterone propionate employed in these animal experiments were, in proportion to body weight, several hundred times greater than the amounts employed by us and other physicians clinically. From the physiological, economical, and practical points of view, it would not be necessary to administer testosterone to man in dosages comparable to those used in animals, since the amounts which we employed gave all the results desired.

The dosages of testosterone employed by us (4) and others (1, 2, 5, 11, 12, 19) over short periods of time resulted in the same initial stage of bone growth stimulation produced in experimental animals (13). While testosterone was administered by us in small to moderate dosages, within the range of safety, careful supervision and frequent physical examinations, especially of the genitalia, were made during the course of therapy in order to avoid bringing on undesirable excessive genital development. Roentgen studies were carried out at intervals of three to four months. Therapy was discontinued at once if any evidence of excessive acceleration of structural density or epiphyseal union was noted.

CASE IV: S. S., white male, age 17, height 63 3/4 in., weight 123 lb., was admitted to the Endocrine Clinic, with hypogonadism and eunuchoidism. His height was normal for his age, yet his body configuration and measurements were eunuchoid, his voice was high-pitched, and his genitalia were underdeveloped. He was taciturn and self-conscious and easily fatigued. Roentgen studies of his wrists and hands revealed the bone structure to be normal in size and density. There was, however, a retardation in epiphyseal union of at least two years (Fig. 8).

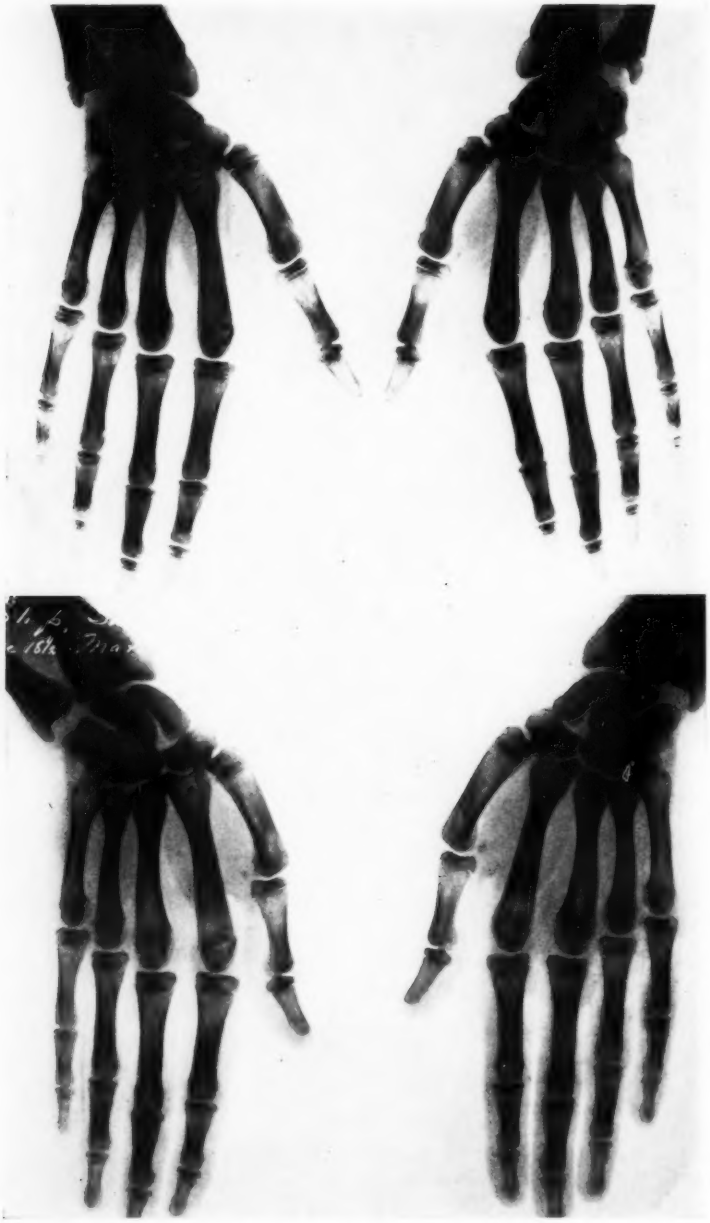
A short period of therapy with chorionic gonadotropin failed to stimulate genital development, and testosterone therapy was initiated and carried out for a period of four months, during which time 800 mg. of testosterone propionate was administered. The therapy resulted in a rapid genital development and an increase in pubic hair, deepening of the voice, and an increase in growth rate of 2 1/4 in. The patient's vitality increased greatly; he became more assured and sociable. Roentgen studies at the completion of therapy and one year later, at the age of 18 1/2, showed an increase in bone length but no change in epiphyseal union (Fig. 9). Testosterone therapy stimulated growth of the long bones in length, but did not affect epiphyseal union.

SUMMARY AND CONCLUSIONS

1. The influence of hormonal therapy on bone growth and development has been observed in 81 children, 18 of whom were treated with thyroid substance, 26 with anterior pituitary growth extract, 19 with chorionic gonadotropin, and 18 with testosterone.

2. Thyroid therapy tended to improve bone density and epiphyseal union. Before therapy was instituted delayed epiphyseal union accompanied by varying degrees of decreased structural density was noted in 6 children, while decreased structural density without delay in epiphyseal union was shown in 4 others. At the conclusion of therapy the bone density was normal in all children, but in 5 the delay in epiphyseal union persisted. There was an improvement in growth rate, physical development, and mental alertness. Best results were obtained with children where a clear indication of thyroid deficiency previously existed.

3. Therapy with anterior pituitary growth extract (26 children) did not yield any conclusive evidence of changes in skeletal growth and development in the majority of our patients. In 4 of the older group of children (14 to 16 years) skeletal maturation and epiphyseal union seemed to progress beyond the normal rates, although such a tendency already existed in 3 children before therapy was initiated. In 11 children with delayed epiphyseal union no effect was produced on bone maturation or epiphyseal union. At the conclusion of therapy and two months to two years following therapy, the epiphyses remained ununited. In the remaining 11



Figs. 8 and 9. Case IV: Results of testosterone therapy.
Fig. 8 (above). Age 17 years. Height 63 3/4 in. Weight 123 lb. Skeletal age 14 years 9 months. Bone structure normal as regards size and density. Delayed epiphyseal union. No scorings on radius.
Fig. 9 (below). Age 18 1/2 years. Height 66 in. Weight 135 lb. Skeletal age 16 years 9 months. Retarded epiphyseal union. No scorings on radius.

children of this group, with fairly normal findings at the start of therapy, bone growth and development proceeded normally. Clinically the growth rate was improved in 8 cases and maintained in 18. There was, however, a general improvement in vitality, muscle tone, and mental alertness in the majority of the children.

4. Chorionic gonadotropin therapy stimulated bone growth in the longitudinal axis but did not accelerate epiphyseal union, bone maturation, or density in the majority of the cases. Only 2 children treated intensively over a period of two years showed increased bone maturation and density. Seventeen children responded by an increase in growth rate; 2 children maintained their original rate of growth. All children showed an improvement in genital development, muscular tone, mental alertness, and social adjustment. There was also a loss of weight in the majority of the obese children.

5. Testosterone therapy showed a tendency to accelerate skeletal growth in length to a somewhat greater degree than chorionic gonadotropin. No hastening of epiphyseal union was observed. A moderate degree of increased bone density was noted in 3 out of 18 children. Clinically 16 children showed an increase in growth rate and 2 maintained their original rate of growth. All children showed improvement in genital development, muscular tone, and self assurance. A gain in weight was noted in the majority. The rapid genital development caused by testosterone therapy necessitated frequent examinations and interruptions of therapy except in 2 eunuchoid boys, who were treated almost continuously.

6. Before hormonal therapy all of the children presented various psychological maladjustments: most of them were shy, self-conscious, and unsociable; others were resentful towards their parents, guardians, or society in general. Following successful endocrine therapy, with improvement in growth and genital and muscular development, there was a tendency to improvement in mental and emotional stability.

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BIBLIOGRAPHY

1. ALBRIGHT, F., BURNETT, C. H., PARSON, W., REIFENSTEIN, E. C., AND SMITH, P. H.: Paper read before Association for Study of Internal Secretions, Atlantic City, May 3, 1941.

2. BROWNE, J. S. L., AND ROSS, A.: Paper read before Association for Study of Internal Secretions, Atlantic City, May 3, 1941.

3. (*a*) EVANS, H. M., AND LONG, J.: Anat. Rec. **21:** 62, 1921.

(*b*) EVANS, H. M., AND LONG, J.: Anat. Rec. **23:** 19, 1922.

(*c*) RAY, R. D., EVANS, H. M., AND BECKS, H.: Am. J. Path. **17:** 509–528, July 1941.

(*d*) EVANS, H. M., SIMPSON, M. E., MARX, W., AND KIBRICK, E.: Endocrinology **32:** 13–16, January 1943.

4. (*a*) FINKLER, R. S., FURST, N. J., AND COHN, G. M.: J. Clin. Endocrinol. **2:** 603–610, October 1942.

(*b*) FINKLER, R. S., AND COHN, G. M.: Arch. Pediat. **60:** 362–380, July 1943.

5. GOLDZIEHER, M. A.: J. Clin. Endocrinol. **1:** 924–927, November 1941.

6. HOSKINS, E. R.: J. Exper. Zool. **21:** 295–346, 1916.

7. JOHNSTON, J. A., AND MARONEY, J. W.: Am. J. Dis. Child. **58:** 965–982, November 1939.

8. KOCHAKIAN, C. D.: Endocrinology **21:** 750–755, November 1937.

9. KENYON, A. T., SANDIFORD, I., BRYAN, A., KNOWLTON, E., AND KOCH, F.: Endocrinology **23:** 135–153, August 1938.

10. LOEB, L.: Harvey Lectures, Series 36, 1940–1941, pp. 228–250.

11. MCCULLAGH, E. P., AND MCGURL, F. J.: Endocrinology **26:** 377–384, March 1940.

12. RAPFOGEL, I.: Endocrinology **27:** 179–184, August 1940.

13. RUBINSTEIN, H. S., AND SOLOMON, M. L.: Endocrinology **28:** 112–114, January 1941; **28:** 229–232, February 1941; Proc. Soc. Exper. Biol. & Med. **45:** 745–748, November 1940.

14. SMITH, P. E.: Am. Anat. Mem. **11:** 151, 1920; Proc. Soc. Exper. Biol. & Med. **30:** 1252–1254, June 1933.

15. SCHÄFER, E. A.: Quart. J. Exper. Physiol. **5:** 203–228, 1912.

16. (*a*) SILBERBERG, M.: Proc. Soc. Exper. Biol. & Med. **32:** 1423–1425, June 1935.

(*b*) SILBERBERG, M., AND SILBERBERG R.: Arch. Path. **29:** 355–367, March 1940.

(*c*) SILBERBERG, M., AND SILBERBERG, R.: Am. J. Path. **17:** 189–210, March 1941.

(*d*) SILBERBERG, M., AND SILBERBERG R.: Am. J. Path. **18:** 1141–1157, November 1942.

(*e*) SILBERBERG, M., AND SILBERBERG, R.: Arch. Path. **32:** 85–95, July 1941.

(*f*) SILBERBERG, M., AND SILBERBERG, R.: Endocrinology **31:** 410–418, October 1942.

17. TURNER, H. H., LACHMANN, E., AND HELLBAUM, A. A.: Endocrinology **29:** 425–429, September 1941.

18. TODD, T. WINGATE: Atlas of Skeletal Maturation (Hand). St. Louis, C. V. Mosby Co., 1937.

19. WEBSTER, B., AND HOSKINS, W. H.: Proc. Soc. Exper. Biol. & Med. **45:** 72–75, October 1940.

Pituitrin for Concentrating Diodrast in Excretion Urography[1]

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THE PURPOSE of this study was to attempt to improve present methods of concentrating diodrast in intravenous urography and to observe the effects of the antidiuretic principle of posterior pituitary extract in relation to the excretion of that foreign material.

In the preparation of a subject for intravenous urography, as for the performance of the urine concentration test, a period of dehydration is necessary. In each instance the strict co-operation of the subject is required for uniform success. Because of this variable, rather elaborate procedures are frequently used to insure maximum dehydration. Elimination of this preliminary preparation in favor of a simple standard procedure which does not require co-operation of the subject, does not depend upon the state of body hydration, can be done in a short time at any time of the day, and yields consistent results within a narrow range, seems a desirable end to be gained.

The antidiuretic effect obtained by the administration of posterior pituitary extract has been utilized as a means of concentrating the urine in renal function tests. The published results to date seem highly significant (1–5). It has been shown that a considerable reduction in urinary output can be obtained in normal persons (2, 3) and in those suffering from renal disease or diabetes insipidus, as well as in animals (6, 7). Without entering upon a discussion of the comparative physiology of the antidiuretic effect, it appears reasonably certain that, at least in mammals, it is the result of increased reabsorption of water in the proximal convoluted tubules and thin portion of Henle's loop (8–10) and is accompanied by an increased urinary output of chloride (3), apparently the result of decreased absorption of that ion by the tubules (8). Moreover, experiments in mammals, by Wakim *et al.* (11), showed no alteration of renal blood flow or blood pressure after subcutaneous administration of pituitrin, furthering the notion of tubular reabsorption of water as the mechansim of antidiuresis.

PROCEDURE

Fifteen patients were submitted to intravenous excretory urography for visualization of renal pelves, calices, and upper ureters. Each patient was first examined with the usual dehydration technic, roentgenograms being made at seven-, fifteen-, and thirty-minute intervals following the intravenous injection of 20 c.c. of 35 per cent diodrast. Pressure across the lower ureters was maintained firmly enough to prevent escape of the diodrast into the bladder. In this series of examinations it was not always possible to compress the ureters completely. The escape of some of the diodrast into the bladder caused a loss of density and detail in the upper urinary tract shadows, but in no case was this factor taken into consideration in judging in favor of the pituitrin effect. Follow-up films over renal, ureteral, and bladder areas were made after release of the pressure.

After establishing the condition of the urinary tract with the patient dehydrated,

[1] Read before the Chicago Roentgen Society in November 1943. Accepted for publication in January 1944.

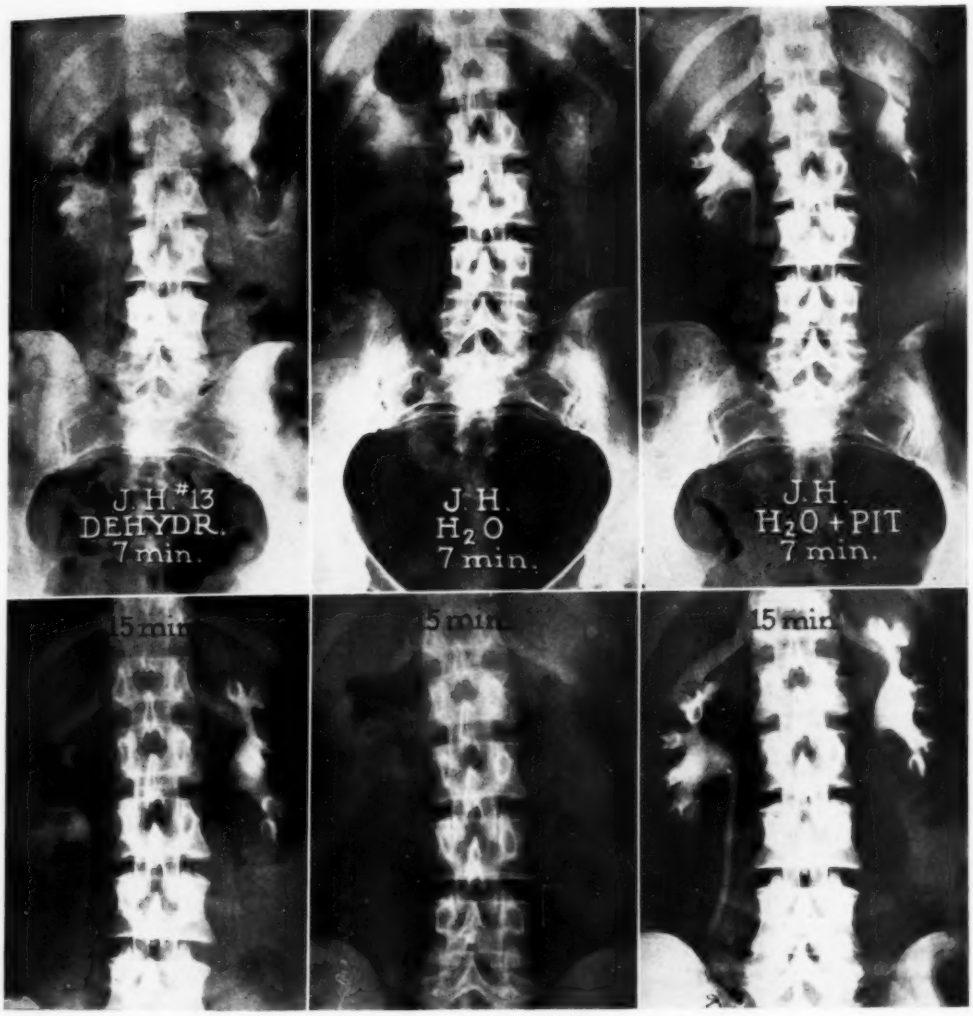

Fig. 1. Patient No. 13. Visualization of the upper urinary tract. On the left, the upper and lower films represent seven- and fifteen-minute exposures after diodrast injection, with patient dehydrated.

The middle films show corresponding seven- and fifteen-minute exposures, on the same patient, after diodrast injection following hydration by 12 ounces of water orally. Poor density and detail result.

The films to the right disclose the good visualization obtained by injection of 1.5 c.c. of pituitary extract, even after 18 ounces of water had been taken by mouth. The concentrating effect of the pituitrin on the urine provides better density and detail of the urinary tract shadows.

12 of the group were examined a second time. For this second examination the patient came unprepared and was given 0.5 c.c. of surgical pituitrin subcutaneously; fifteen minutes later, after emptying the bladder, he was given 18 ounces of water orally. This large quantity of water was given solely for the purpose of putting the antidiuretic effect of pituitrin to a severe test. One hour later (one hour and fifteen minutes after pituitrin), 20 c.c. of diodrast was injected intravenously and films were exposed at intervals of seven and fifteen minutes. This time interval between the injection of pituitrin and diodrast was selected on the basis of Sodeman and Engelhardt's experimental studies of urine specific gravity. The shadows of the

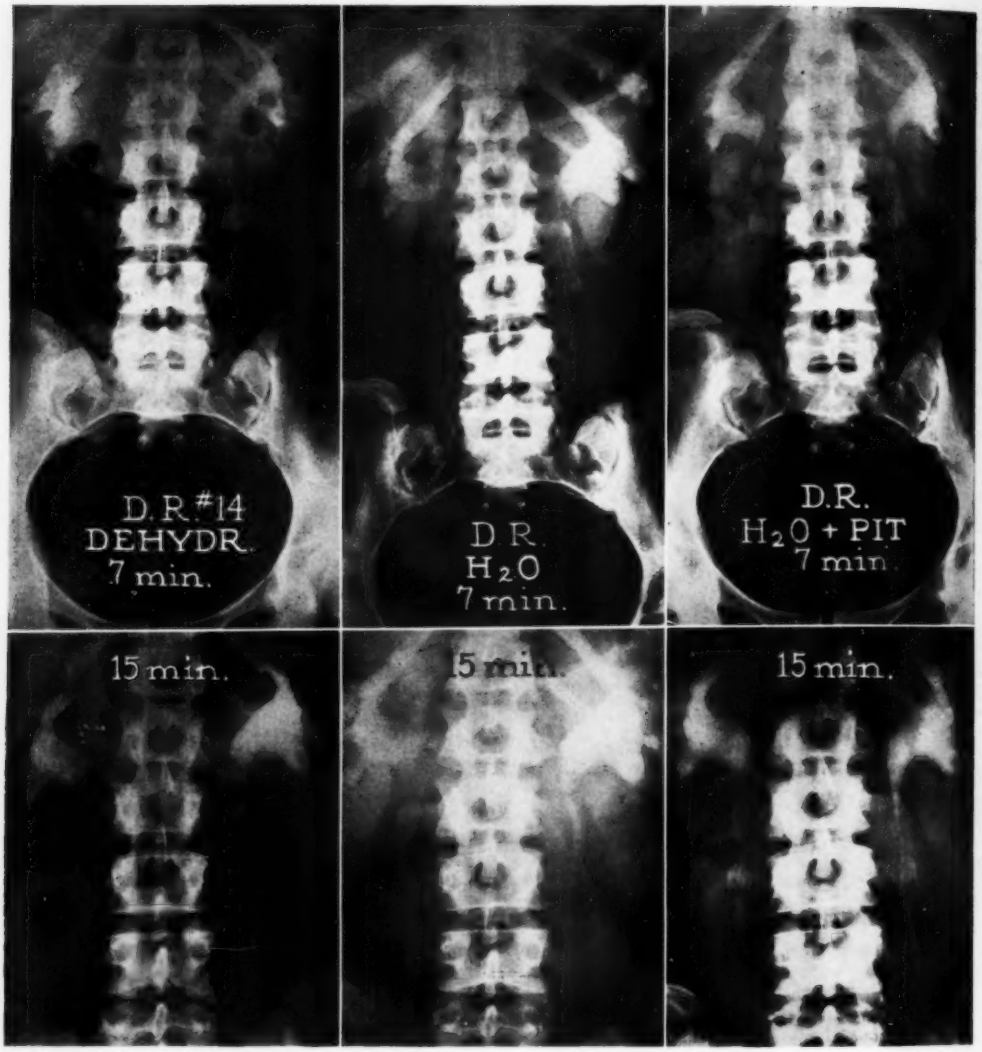

Fig. 2. Patient No. 14. Visualization of urinary tract as in Figure 1. Again the seven- and fifteen-minute exposures made following the pituitrin injection method (even after the ingestion of 18 ounces of water) show as good density and detail as obtained by thorough dehydration, and better by far than gained by drinking smaller amounts of water (12 ounces) without pituitrin injection.

urinary tract were compared for density and detail with those on the corresponding seven- and fifteen-minute films in the preliminary study.

Part of the group of patients was studied a third time. Eight of those previously examined were purposely hydrated with 12 ounces of water an hour before the injection of 20 c.c. of diodrast. Again seven- and fifteen-minute films were made in the same manner as in the original study. Three others of the original group were reexamined without any preparation whatever, and seven- and fifteen-minute films were taken to compare with those of the preliminary study done with dehydration.

Following this, another group of 24 patients was examined to whom only 0.2 c.c.

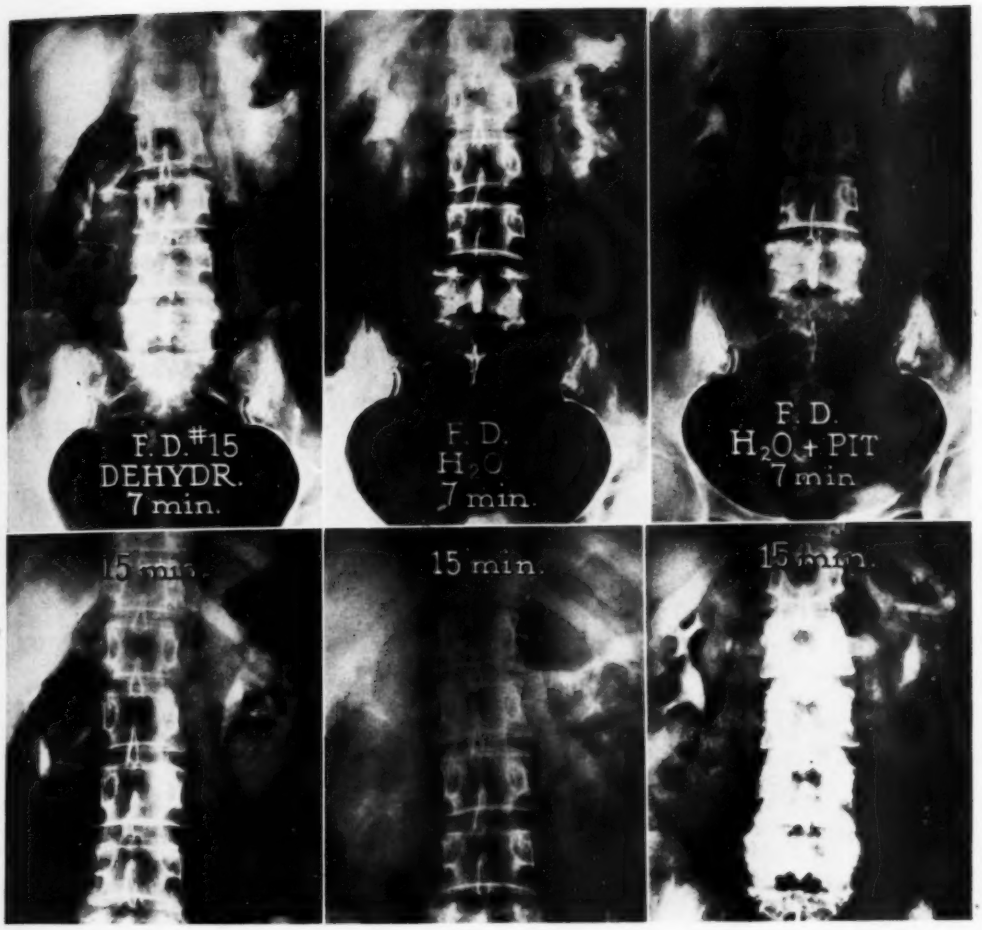

Fig. 3. Patient No. 15. Visualization of urinary tract after the three methods of preparation shown in Figures 1 and 2. Again, better density and detail were obtained on the seven- and fifteen-minute exposures by using pituitrin, even after excessive amounts (18 ounces) of water by mouth.

pituitrin was administered. These patients came wholly unprepared, after breakfasts which included fluids in quantities from 3 to 12 ounces. On theoretical grounds the smaller dosage should give adequate antidiuresis, with a lessened tendency toward unpleasant side actions.

RESULTS[2]

1. Of 15 patients subjected to intravenous urography after preparation by a standard dehydration technic, 11 showed good visualization, three showed fair visualization, and in one, who had a right ureteropelvic obstruction, visualization was poor.

2. Of 12 patients subjected to a second intravenous pyelography, after administration of pituitrin, all save one showed visualization equal to or better than that shown previously. (The patient in whom visualization was poor was very small and probably could not concentrate the relatively large quantity of water given.)

3. Of the 8 patients subjected to a third urography without preparation of any sort except the administration of a large quantity of water, 3 showed good visualiza-

[2] See also Table I.

TABLE I: DEGREE OF VISUALIZATION OF URINARY TRACT OBTAINED BY INTRAVENOUS DIODRAST INJECTION AFTER VARIOUS PREPARATORY TECHNICS

Patient	Dehydration	Water and Pituitrin	Water	No Preparation	Remarks
1	Fair	Fair to good	Fair	.....	Lower left ureteral stone
2	Fair	Fair (7 min.) Good (15 min.)	.....	.....	Left ureteral leak on first study
3	Good	Good	Good	.....	.....
4	Good	Good	.....	.....	.....
5	Good	Good	Fair	.....	.....
6	Good	Very good	Good	.....	.....
7	Good	Poor	.....	.....	Small patient
8	Good	Good	Poor (7 min.) Good (15 min.)	.....	.....
9	Poor	.....	.....	Fair	.....
10	Good	.....	.....	Fair	Pregnant
11	Good	Good	.....	.....	.....
12	Fair	.....	.....	Good	Right uretero-pelvic obstruction
13	Good	Good	Poor	.....	.....
14	Good	Good	Fair	.....	Renal ptosis
15	Good	Good	Poor	.....	.....

tion equal to that of the original examination.

4. In another group of 3 patients subjected to urography without preparation of any sort, 2 had as good or better visualization than on the preliminary study.

5. Of the group of 24 patients subjected to urography after the administration of 0.2 c.c. pituitrin but without preparation of any other type, 15 showed good concentration of dye, 6 a fair concentration, and 3 gave poor visualizations.

DISCUSSION

Patients with coronary artery disease and pregnant women were not given pituitrin. Two patients had mild reactions from 0.5 c.c. pituitrin in the form of temporary diarrhea, while one of the 24 receiving 0.2 c.c. suffered transient weakness, nausea, and blanching of the skin. No other untoward reactions were observed. Blood pressures were not recorded.

It is noteworthy that of the original group of 15 patients, half of those who were given either 12 ounces of water or came unprepared (see Table I, columns headed Water and No Preparation) still had good urinary tract visualization although no pituitrin was used. The reason for this probably lies in the fact that the study was carried on in the hottest part of the summer. Moreover, some patients unwittingly restricted fluid and food intake contrary to instructions, because they had done so for the previous study. We believe they were sufficiently dehydrated to allow for good concentration of diodrast even after ingestion of 12 ounces of water. These variable factors were eliminated in our second group of 24 patients, all of whom were studied during the winter months and came uninstructed and unprepared in any way.

Regarding the question of the influence of the pituitrin upon the bowel and its contents, and the possible relation of this to the quality of the urographic visualization, we noted that 0.5 c.c. of pituitrin caused a shifting of bowel content and occasionally a watery stool. Frequently segments of the colon became more distended with gas, and where this occurred the contrast between these superimposed gas shadows and the renal pelves, calices, ureters, and surrounding structures accentuated their visualization. The effect of the pituitrin was judged on the basis of actual diodrast density and not on the basis of contrast due to superimposed gas shadows.

It should be emphasized that the large quantities of water taken before the administration of pituitrin were given merely to put the antidiuretic effect to a severe test and not because this is an essential for routine procedure. The ordinary radiologic procedure would simply include the administration of pituitrin one to two hours

before the injection of diodrast without preliminary preparation of the patient. On the other hand, pituitrin injection may be somewhat dangerous to a patient already severely dehydrated, and such persons should be given fluids if pituitrin is to be used for routine examination.

Although no quantitative interpretation can be made from these results, it may be concluded that there is no significant sustained alteration in renal blood flow as a result of the influence of the antidiuretic hormone, since diodrast appears promptly in the urine. It follows that tubular reabsorption is the mechanism of pituitrin antidiuresis. These data are consistent with the work of others (9, 11, 12) who have arrived at these conclusions by more direct and quantitative methods.

SUMMARY AND CONCLUSIONS

One-half cubic centimeter (10 units) of pituitrin administered subcutaneously will suppress 18 ounces of water ingested at the same time in an adult patient of average weight. By the use of pituitrin, the density and detail of the upper urinary tract shadows cast by diodrast administered intravenously can be improved without harm to the patient, although he may be markedly hydrated. The use of such a technic is of particular value when a prompt study is desired in a patient not previously prepared.

While the tendency toward unpleasant side actions from the injection of pituitrin is lessened by the use of a smaller dose (0.2 c.c.), the larger dose (0.5 c.c.) insures a greater probability of good visualization.

NOTE: The diodrast used in these studies was generously supplied by the Department of Medical Research, Winthrop Chemical Co., Inc.

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BIBLIOGRAPHY

1. BRUNN, F.: Med. Klin. **17:** 871, July 21, 1921.
2. PASQUALINI, R. Q., AND ETALA, E.: Rev. Soc. argent. de biol. **16:** 161–173, June 1940.
3. SODEMAN, W. A., AND ENGELHARDT, H. T.: (*a*) Proc. Soc. Exper. Biol. & Med. **46:** 688–691, April 1941; (*b*) J. A. M. A. **122:** 1070–1072, Aug. 14, 1943.
4. WALL, H. C.: Arch. Int. Med. **71:** 454–459, April 1943.
5. PAINE, W. G., AND NELSON, E. E.: Proc. Soc. Exper. Biol. & Med. **42:** 729–731, December 1939.
6. MURPHY, D. P.: (*a*) Am. J. Obst. & Gynec. **42:** 281–285, August 1941; (*b*) Surg., Gynec. & Obst. **73:** 175–180, August 1941.
7. SILVETTE, H.: Am. J. Physiol. **131:** 601–605, January 1941.
8. SILVETTE, H.: Am. J. Physiol. **128:** 747–753, March 1940.
9. BURGESS, W. W., HARVEY, A. M., AND MARSHALL, E. K., Jr.: J. Pharmacol. & Exper. Therap. **49:** 237–249, October 1933.
10. GERSH, I.: J. Pharmacol. & Exper. Therap. **52:** 231–234, October 1934.
11. WAKIM, K. G., HERRICK, J. F., BALDES, E. J., AND MANN, F. C.: J. Lab. & Clin. Med. **27:** 1013–1022, May 1942.
12. SHANNON, J. A.: J. Exper. Med. **76:** 387–399, October 1942.

Angiocardiography[1]

Anatomy of the Heart in Health and Disease

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ANGIOCARDIOGRAPHY had its beginning in 1928, when Robb and Weiss (1) started their studies on cardiac physiology and circulation time in order to ascertain whether visualization of the heart was feasible. Angiocardiography has elucidated many enigmas of the heart and great vessels and has also made it possible to differentiate the vascular from the nonvascular lesions of the mediastinum.

In 1931 Forssmann of Germany (2) succeeded in demonstrating the right auricle by introducing into it an iodine preparation, by means of a ureteral catheter, through the veins of the right arm. Subsequent investigators have employed this procedure or some modification of it for demonstration of the cardiac chambers and the great vessels leading to and from the heart. Egas Moniz of Portugal (3) and Ravina (4) and others in France used Forssmann's technic to visualize the pulmonary vessels.

In the Western hemisphere, the pioneers in the roentgen demonstration of the abnormalities of the heart and great vessels were Castellanos and Pereiras of Cuba (5–14). Their work, begun in 1931, antedates all work of record in the United States. Their method was devised for infants and children, living and dead, and did not differ fundamentally from that now in use. They threaded a Lindemann cannula into the vein of the arm, preferably the right, and injected 10 to 20 c.c. of a 35 per cent solution of perabrodil. In their later work, however, uroselectan B was used with satisfactory results, not only in the newborn and infants, but also in older children. By their method they visualized only the right heart and pulmonary tree. The left side was demonstrable only if an interauricular or interventricular septal defect was present. In many instances, Castellanos and Pereiras had the opportunity of comparing their roentgen observations with postmortem findings.

In the United States Robb and Steinberg in 1938 (15) described a practical method for the visualization of the heart and great vessels. Robb, five years earlier (16), while in Boston, had himself injected with 20 c.c. of uroselectan, hoping to be able to visualize his own heart and vessels by fluoroscopy. As a result of this injection an extensive thrombophlebitis of the vessels of his arm resulted, and the work was temporarily discontinued.

The recent literature contains more than a hundred papers on angiocardiography. They range in scope from descriptions of technic to accounts of the demonstration of congenital malformations and differential diagnosis of mediastinal lesions. Notable among the writers are Sussman, Steinberg and Grishman (17, 18, 19), whose work on congenital lesions, intrapulmonary lesions, and technic constitutes a valuable contribution in the field of angiocardiography.

ANATOMY OF THE NORMAL HEART

We have found variations from the recognized and accepted radiographic picture of the normal cardiac silhouette. This type of examination affords a means of

[1] Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

determining the size and shape of the heart, the presence or absence of cardiac hypertrophy, chamber enlargement, or both; also, the location of the valves and the position of the chambers, the ventricular conus, the pulmonary aorta and its branches, the aorta, and the border-forming structures of the cardiac silhouette.

Fig. 1. Postero-anterior view, showing left innominate vein, superior vena cava, right auricle, right ventricle, ventricular conus, pulmonary aorta, right and left pulmonary arteries.

Postero-Anterior Position: Figure 1 is a postero-anterior view. (1) The superior vena cava, right auricle and ventricle, and the pulmonary aorta appear as a "U"-shaped structure occupying about one-half the frontal cardiac silhouette, seldom extending beyond the left lateral margin of the vertebral column. (2) The superior vena cava occupies the upper right margin of the cardiac silhouette. It may extend down to the diaphragm before emptying into the right auricle, constituting the major portion of the right cardiac border. (3) Usually the right auricle forms the lowermost part of the right border, extending down to the dome of the diaphragm. (4) The right ventricle has a short horizontal

Fig. 2. Postero-anterior view, showing left innominate vein, superior vena cava, right auricle, right ventricle, right ventricular apex, ventricular conus, area of pulmonary valves, pulmonary aorta, bifurcation into left and right pulmonary arteries.

and a rather long vertical portion, the uppermost part representing the area of the conus arteriosus (Fig. 2). (5) The tricuspid valve area may be identified by a constriction between the auricle and ventricle, giving a butterfly appearance to the right heart (Fig. 3). (6) Immediately above the conus is a constriction representing the region of the pulmonary valves, and above it is the pulmonary aorta. The lowermost portion of the right border of the cardiac silhouette, on occasion, may contain a non-opacified area, which on kymographic examination will show pulsations with ventricular characteristics. It is our opinion that this non-opacified area is occupied by the inferior vena cava.

The right heart does not occupy more than about one-half of the cardiac silhouette. The ascending aorta, normally, does not form part of the right cardiac border. This is made up of the superior vena cava and the right auricle, with the inferior vena cava participating at times in forming the lowermost portion. The right

Fig. 3. Postero-anterior view, showing left innominate vein, superior vena cava, right auricle, tricuspid area, right ventricle, ventricular conus, pulmonary aorta, bifurcation into left and right pulmonary arteries.

ventricle is situated deep within the cardiac silhouette and is far removed from the left cardiac border. The ventricular conus or conus arteriosus is a centrally located structure and does not participate in forming any portion of the left border of the cardiac silhouette. The pulmonary aorta may at times reach the left cardiac border and participate in its formation. The left pulmonary artery frequently forms part of the left middle cardiac segment. This artery is situated at a slightly higher level than the right. The interventricular septum is vertical and convex to the right. The apex of the right ventricle forms an acute angle far removed from the cardiac apex.

The left heart, when opacified, assumes a figure-of-eight form, obliquely situated at an angle of about 30° from the horizontal (Fig. 4). The left auricular shadow is circular in outline, is disposed more to the right than to the left, and does not form part of either cardiac border except for the left auricular appendage, which may be

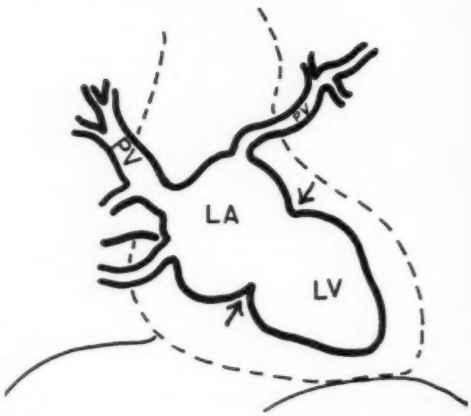

Fig. 4. Postero-anterior view of left heart. Note the figure-of-eight form of the left heart. The auricular shadow is situated to the right of the left ventricular shadow and is non-border-forming. Note mitral area.

border-forming on the left side. The left ventricular shadow is oval, occupying the major portion of the left half of the heart. A constriction between the auricle and ventricle is the location of the mitral ring or annulus.

The ascending aorta is the continuation of the left ventricle, arising well within the right half of the cardiac silhouette. It

Fig. 5. Postero-anterior view, showing left ventricle in systole and the aorta outlined.

proceeds slightly upward and to the right, then bends toward the left as it passes upward and across the spine, bending on itself and descending along the left lateral border of the spine. The aorta (Fig. 5) forms no part of the right cardiac border, except when tortuous, elongated, or dilated.

The left cardiac border is formed from above downward by the aorta, the middle cardiac segment, and the left ventricle. The middle cardiac segment is the area between the aortic arch and the base of the left ventricle. It is at times composed of the pulmonary aorta as it ascends, just before it bifurcates, and above it the left pulmonary artery. More often, however, this latter vessel is the prominent structure in this area. The descending aorta may also be the border-forming structure of the middle cardiac segment. At the junction of the lower portion of the middle cardiac segment and the base of the left ventricle is a small non-opacified area, which we believe to be the left auricular appendage.

In the supracardiac area, the superior vena cava is to the right of the aorta. The

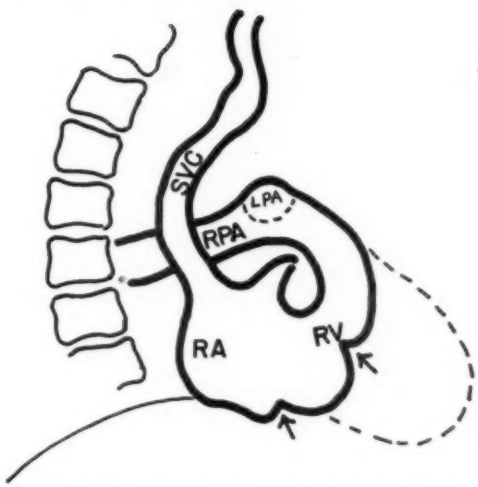

Fig. 6. Right anterior oblique view, showing superior vena cava, right auricle, tricuspid area, right ventricle, ventricular conus, pulmonary aorta, left pulmonary artery.

ascending and descending portions of the aorta may be either superimposed, adjacent to, or separated from each other.

Right Anterior Oblique Position: The superior vena cava, the right auricle, the right ventricle, and the pulmonary aorta present a "U"-shaped structure in the postero-anterior view. This same "U"-

Fig. 7. Right anterior oblique view, showing left heart, aorta, left auricle, mitral area, left ventricle.

shaped structure is visualized in the right anterior oblique position (Fig. 6), presenting a more curved appearance with a wider separation of the limbs of the "U." In this position the superior vena cava can be traced into the right auricle, which rests on the diaphragm and does not encroach upon the retrocardiac space. The right ventricle forms the horizontal and ascending portions of the "U." The tricuspid valve area is represented by a constriction between the auricle and ventricle, giving the right heart a butterfly appearance. A second constriction may be present where the outflow tract of the right ventricle continues as the pulmonary aorta. This represents the site of the (ventricular) conus arteriosus and is situated deep within the cardiac silhouette. At times the location of the cusps of the pulmonary valves may be recognizable. In this position the pulmonary aorta is border-forming. The right pulmonary artery is foreshortened, and the left is visualized in its length crossing the clear space and subdividing in the left lung. The right ventricle is located in the posterior half of the cardiac silhouette and is not a border-forming structure anteriorly.

The left auricle and the left ventricle form a figure-of-eight, lying in an almost horizontal plane, with the auricular shadow at a slightly higher level and posterior to the ventricular shadow. The auricle does not form any part of the cardiac border in this position. A constriction between the auricular and ventricular shadows represents the annulus or the mitral valve area. The left ventricle occupies the greater part of the cardiac silhouette and is border-forming anteriorly (Fig. 7).

Left Anterior Oblique Position: The two arms of the "U"-shaped structure of the right heart, shown in the postero-anterior and right anterior oblique positions, are superimposed in the left anterior oblique view (Fig. 8) and form an elongated rectangular structure with a slight anterior convexity in its long axis. The right auricle and right ventricle cannot be identified as separate chambers. The interventricular septum, or posterior boundary of the right ventricle, is convex to the right. The superior vena cava enters posteriorly. The left pulmonary artery is foreshortened and the right is visualized in its full length. The auricle rests on the diaphragm. The ventricular conus is visualized, as are the pulmonary aorta, its bifurcation, and the right and left pulmonary arteries.

The left heart appears as a kidney-shaped structure with its hilum directed upward and anteriorly (Fig. 9). The upper and smaller part is the left auricle. The lower and larger part is the left ventricle. A constriction separating the upper from the lower part represents the site of the mitral valve or annulus. The pulmonary veins enter the auricle posteriorly. The aorta arises from the upper and anterior portion of the ventricular shadow, describes an arc in the thorax, and descends along the vertebral column.

Lateral Position: In this projection the contours of the right and left portions of the heart are similar to those observed in the left anterior oblique position.

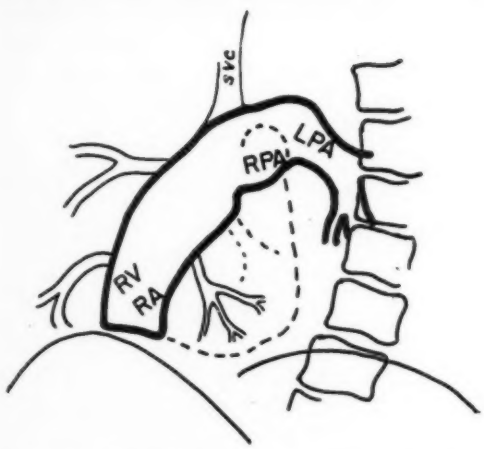

Fig. 8. Left anterior oblique view, showing elongated rectangular right heart.

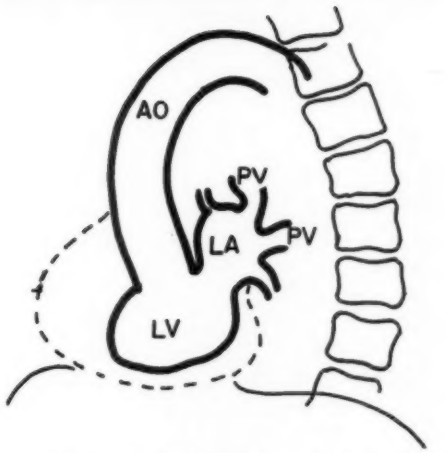

Fig. 9. Left anterior oblique view of left heart: a kidney-bean-shaped structure.

PATHOLOGIC ANATOMY

Cardiac enlargement may be due to hypertrophy, chamber enlargement, or both. In the postero-anterior projection, chamber enlargement of the right heart presents a "U"-shaped structure similar to that seen in the normal heart, but wider (Fig. 10). It is dilated and occupies a larger area but does not occupy the entire frontal plane of the cardiac silhouette. The interventricular septum is shifted to the left. The left ventricle occupies a good portion of the cardiac silhouette. The middle segment of the left heart is accentuated and appears either flattened or convex.

In the left anterior oblique position the enlarged right heart presents a shape quite different from that normally observed. It may be globular, it may resemble an in-

Fig. 10. Postero-anterior view, showing enlarged right heart, right innominate vein, superior vena cava, right auricle, tricuspid area, right ventricle, pulmonary aorta, right pulmonary artery. The aortic knob is seen with calcific plaque.

verted mushroom (Fig. 11) with the greatest enlargement inferiorly, or it may present a tongue-like appearance with the greatest enlargement superiorly (Fig. 12). At times the interventricular septum is convex to the left; more often, however, it is convex to the right. The auricular and ventricular shadows merge, the ventricular conus being located above and anteriorly, continuing as the pulmonary aorta, which is prominent, and divides into the pulmonary arteries (Fig. 13).

The left heart chamber enlargement is demonstrable in all projections. In the postero-anterior view one or both of the component parts of the figure-of-eight, are enlarged. Auricular enlargement tends to be spherical, moving to the right; the enlarged auricle is not a border-forming structure of the left side. Ventricular enlargement is oval and moves to the left and downward.

In the left anterior oblique projection left ventricular chamber enlargement shows an encroachment on the right heart area. The left ventricular shadow becomes oval

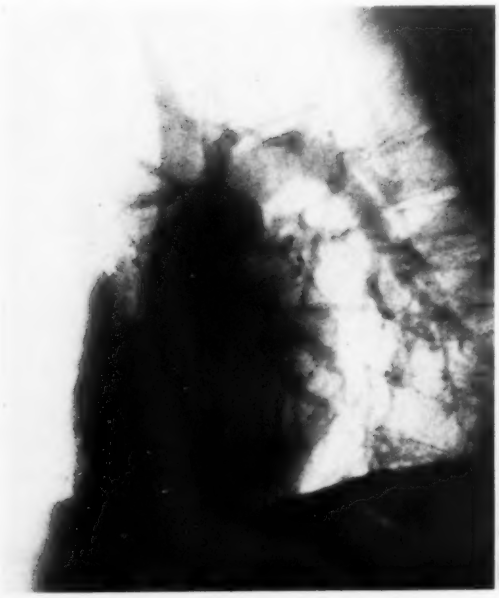

Fig. 11. Left anterior oblique view: mushroom-shaped right heart.

Fig. 12. Left anterior oblique view: tongue-like large right heart.

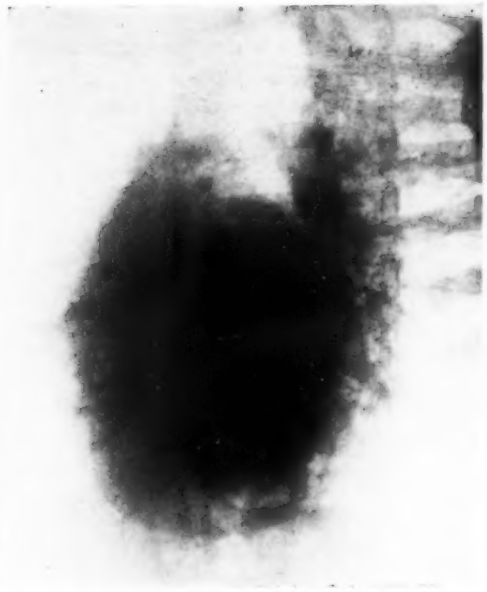

Fig. 14. Left anterior oblique view of enlarged left heart, showing tongue-like shadow with no differentiation between aorta and left ventricle.

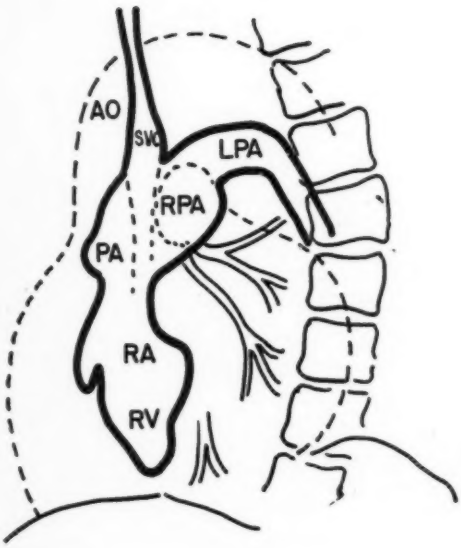

Fig. 13. Left anterior oblique view: large right heart.

and advances anteriorly and posteriorly. The interventricular septum is curved anteriorly and is situated more anteriorly. In a few instances the left heart enlargement presented a tongue-like appearance (Fig. 14), with the greatest enlargement above, not unlike that found in right heart enlargement.

The above statements are based upon observations made in 120 persons. Eighteen of these were normal; the remainder of the group had various cardiovascular disorders.

SUMMARY

The normal appearance of the heart chambers and the large vessels is described, as are the changes observed in size and shape in cardiac patients with and without hypertrophy.

This type of study permits of a differentiation of vascular from non-vascular mediastinal lesions. It is of value in congenital cardiac and vascular anomalies.

The cardiac anatomy as demonstrated roentgenographically is not entirely in accord with descriptions found in textbooks. We observed that the middle cardiac segment is formed most often by the left pulmonary artery, infrequently by the pulmonary aorta, and sometimes by both. The descending aorta may participate. The conus (ventricular) is deeply situated; it is

never a border-forming structure and is quite removed from the (concave) middle cardiac segment.

In the postero-anterior projection the right heart does not occupy the major portion of the cardiac silhouette. In the right anterior oblique projection, the left heart occupies a considerable portion of the cardiac silhouette anteriorly.

Two non-opacified areas were found in the cardiac silhouette. One, at the lower portion of the right cardiac silhouette, is thought to be the inferior vena cava. The other, at the junction of the middle cardiac segment and base of the left ventricle, is believed to be a solid portion of the left auricular appendage.

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BIBLIOGRAPHY

1. WEISS, SOMA, ROBB, GEORGE P., AND BLUMGART, HERMAN L.: Velocity of Blood Flow in Health and Disease as Measured by the Effect of Histamine on the Minute Vessels. Am. Heart J. **4:** 664–691, August 1929.

2. FORSSMANN, W.: Ueber Kontrastdarstellung der Höhlen des lebenden rechten Herzens und der Lungenschlagader. München. med. Wchnschr. **78:** 489–492, March 20, 1931.

3. EGAS MONIZ, LOPO DE CARVALHO, AND ALMEIDA LIMA: Angiopneumographie. Presse méd. **39:** 996–999, July 4, 1931.

4. RAVINA, A.: L'exploration radiologique des vaisseaux pulmonaires par l'injection de substances de contraste. Progrès méd., pp. 1701–1705, Nov. 3, 1934.

5. CASTELLANOS, A.: Sobre el diagnóstico angiocardiográfico de la comunicación inter-ventricular. Arch. latino am. de cardiol. y hemat. **8:** 1–18, January–February, 1938.

6. CASTELLANOS, A., PEREIRAS, R., AND ARGELIO GARCIA; L'angiocardiografía radio-opaca. Arch. Soc. estud. clin. Habana, **31:** Nos. 9 and 10, September–October, 1937.

7. CASTELLANOS, A., PEREIRAS, R., ARGELIO GARCIA, AND VAZQUEZ PAUSSA, A.: On Factors Intervening in Obtention of Perfect Angiocardiograms. Bol. Soc. cubana de pediat. **10:** 217–223, May 1938.

8. CASTELLANOS, A., PEREIRAS, R., AND ARGELIO GARCIA: L'angio-cardiographie chez l'enfant. Presse méd. **46:** 1474–1477, Oct. 5, 1938.

9. CASTELLANOS, A., PEREIRAS, R., AND MONTERO, R.: Ingurgitación permanente de la yugular externa izquierda en el niño. La angiocardiografía en los síndromes mediastinales. Arch. de med. int. **3:** 459–474, 1937.

10. CASTELLANOS, A., PEREIRAS, R., AND VAZQUES PAUSSA, A.: On Special Automatic Device for Angio-Cardiography. Bol. Soc. cubana de pediat. **10:** 209–215, May 1938.

11. CASTELLANOS, A., AND PEREIRAS, R.: Actual State of Angio-Cardiography. Arch. de med. inf. **8:** 250–255, July–September 1939.

12. CASTELLANOS, A., PEREIRAS, R., AND ARGELIO GARCIA: Angio-Cardiographies in New-Born. Bol. Soc. cubana de pediat. **10:** 225–244, May 1938.

13. CASTELLANOS, A., PEREIRAS, R., AND ARGELIO GARCIA: On Diagnosis of Solitary Inter-Auricular Communication by Means of Post-Mortem Angiocardiography. Bol. Soc. cubana de pediat. **10:** 277–292, May 1938.

14. CASTELLANOS, A., PEREIRAS, R., AND ARGELIO GARCIA: La angiocardiografía. Rev. de cien. méd. **1:** 1–10, July 1938.

15. ROBB, G. P., AND STEINBERG, I.: Visualization of the Chambers of the Heart, the Pulmonary Circulation and the Great Blood Vessels in Man: Practical Method. Am. J. Roentgenol. **41:** 1–17, January 1939.

16. Personal communication.

17. GRISHMAN, A., STEINBERG, M. F., AND SUSSMAN, M. L.: Contrast Roentgen Visualization of Coarctation of the Aorta. Am. Heart J. **21:** 365–370, March 1941.

18. GRISHMAN, A., STEINBERG, M. F., AND SUSSMAN, M. L.: Tetralogy of Fallot: Contrast Visualization of Heart and Great Vessels. Radiology **37:** 178–180, August 1941.

19. SUSSMAN, M. L., STEINBERG, M. F., AND GRISHMAN, A.: Multiple Exposure Technique in Contrast Visualization of Cardiac Chambers and Great Vessels. Am J. Roentgenol. **46:** 745–747, November 1941.

Erythroblastic Anemia

With Report of a Case in a Boy Eight Years Old[1]

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ERYTHROBLASTIC anemia, Mediterranean anemia, thalassemia, or Cooley's anemia was separated by Cooley in 1927 from the group of anemias showing the von Jaksch syndrome, on the basis of its racial incidence. The disease is familial, occurring only in children of the races derived from the Mediterranean region, especially Greece and Italy. It is characterized by a slowly progressing anemia and by the presence of a large number of nucleated red cells.

The extraordinary proliferation of erythroblastic tissue leads to changes in the bones, especially in the skull. Extreme pallor of the skin with an icteric tint may be the first sign, then a prominent abdomen from splenomegaly. These signs and symptoms may increase, and evidences of cardiac insufficiency may become manifest. Periods of unexplained fever may occur. Physical development may be retarded. A mongoloid appearance is the next condition that goes to make up the picture. There may be epicanthus and mild exophthalmos.

The skull shows prominent frontal and parietal bosses; by contrast the sutures may appear depressed. The liver and lymph nodes are generally enlarged, great enlargement of the spleen is constant, frequently the heart is hypertrophied, and there may be a systolic murmur. In severe cases of long standing, myocardial damage may be demonstrated.

Roentgen examination of the skeleton shows osteoporosis of the long bones with trabeculae standing out clearly. The cortex is thin. The medullary cavity is widened and transverse lines are conspicuous. In the skull the space between the tables is widened, and the outer table is reduced to such thinness as not to be visible on the roentgenogram. The trabeculae connecting the inner and outer tables give the appearance of "hair standing on end."

Blood studies usually show a low color index, marked anisocytosis and poikilocytosis, immaturity of red cells, increase in platelets and a polymorphonuclear leukocytosis with numerous immature cells. Reticulocytes are somewhat increased, constituting 5 to 20 per cent of the red cells. Fragility tests have shown a prolongation of the span of hemolysis, beginning at 0.50 to 0.54 per cent, complete at 0.30 to 0.20. According to Cooley and Lee, the red cells have certain specific characteristics. They tend to be large and to have an uneven distribution of hemoglobin. An abnormality of the stroma has also been described, which, however, may also be encountered in sickle-cell anemia. Increased blood destruction occurs but is not so marked as in sickle-cell anemia. The bilirubin content of the blood is increased, the Van den Bergh reaction is indirect.

Whether a "latent" form of erythroblastic anemia exists remains a question. The course of the disease is progressive, but some patients may survive into adult life. At times there are periods of hyperpyrexia, without other evidence of infection. Death, however, is usually due to infection.

In the opinion of some writers transfusion is a reliable therapeutic measure. Splenectomy causes an extraordinarily prolonged erythroblastic crisis, the nucleated red cells remaining high for months or even years. Very little is accomplished generally by this means. All therapeutic measures used so far have in the end been futile.

[1] Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

Fig. 1. Pathological fracture of lower third of the left femur.

Caffey (1) gives a very full presentation of the subject, recording his studies in 21 cases of erythroblastic anemia, 15 cases of sickle-cell anemia, and 6 cases of chronic hemolytic anemia. He found that there were no significant changes in the long bones in the cases of sickle-cell anemia, nor were vertical striations of the skull found in any case. In the 6 cases of hemolytic icterus no significant changes were found in the long bones, though 2 patients showed striations of the calvarium similar to those seen in erythroblastic anemia. In each instance the parietal bones were more involved than the frontal.

Borzell (2) reported 3 cases of erythroblastic anemia in 1933, 2 of his own and 1 of Dr. Ralph S. Bromer. Borzell states that one of the patients under his care improved following therapeutic application of roentgen rays; the spleen was reduced to normal size, the weight increased, and the appetite improved. Not only did the bone changes fail to progress but there was some improvement.

Baty, Blackfan, and Diamond (3) published a series of 20 cases in 1932 and presented a review of 26 cases reported by other authors.

Feingold and Case (4) reported a case

Fig. 2. Skull roentgenogram showing vertical striations, giving the appearance of hair standing on end.

with skull findings characteristic of erythroblastic anemia and gave some interesting points on other anemias of children and on comparable findings in the skulls of Peruvian Indians. Whipple and Bradford (5) reported 3 cases and criticized the terminology as unsatisfactory, suggesting the term Mediterranean anemia or thalassemia.

Cooley and Lee (6), writing five years after Cooley's first paper, state that their further experience with erythroblastic anemia has strengthened their conviction that it is a clinical entity. All the cases originally reported by Cooley (7) occurred in Italians or Greeks.

Fig. 3. Roentgenogram showing prominence of bones of face and upper jaw.

CASE REPORT

F. C., a boy aged eight, of Italian parentage, was admitted to St. Joseph Hospital, Carbondale, Penna., on April 15, 1943, for an x-ray examination of the left femur. This disclosed a complete fracture of the lower third of the bone (Fig. 1). Since it was clearly evident that the bone was diseased at the site of fracture, further examinations of the skeleton were made. Changes characteristic of erythroblastic anemia were found in the skull (Figs. 2 and 3). Vertical striations are plainly demonstrated, as are thinning of the outer table and marked enlargement and osteoporosis of the bones of the upper jaw and face, in Figures 2 and 3. Changes were also present in the spine and ribs. The ribs showed widening of the medullary canal and thinning of the cortex.

The patient appeared poorly nourished. The spleen was more than moderately enlarged. The liver was not enlarged and there were no heart murmurs.

The blood count was: red cells 2,750,000; white cells 12,000; hemoglobin 44 per cent. There were 10 to 15 nucleated red cells to the oil immersion field.

The patient left the hospital after the fracture healed. Later we were informed that he was taken to another institution, where a splenectomy was done. He was alive at this writing, Jan. 3, 1944, but in poor condition.

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REFERENCES

1. CAFFEY, JOHN: Skeletal Changes in the Chronic Hemolytic Anemias (Erythroblastic Anemia, Sickle Cell Anemia and Chronic Hemolytic Icterus). Am. J. Roentgenol. **37:** 293–324, March 1937.

2. BORZELL, F. F.: Erythroblastic Anemia. Am. J. Roentgenol. **30:** 657–667, November 1933.

3. BATY, J. M., BLACKFAN, K. D., AND DIAMOND, L. K.: Blood Studies in Infants and Children; Erythroblastic Anemia. Am. J. Dis. Child. **43:** 667–704, March 1932. (Correction **43:** 122, May 1932.)

4. FEINGOLD, BENJAMIN F., AND CASE, JAMES T.: Roentgenologic Skull Changes in the Anemias of Childhood. Am. J. Roentgenol. **29:** 194–202, February 1933.

5. WHIPPLE, G. H., AND BRADFORD, W. L.: Racial or Familial Anemia of Children Associated with Fundamental Disturbances of Bone and Pigment Metabolism (Cooley-von Jaksch). Am. J. Dis. Child. **44:** 336–365, August 1932.

6. COOLEY, THOMAS B., AND LEE, PEARL: Erythroblastic Anemia: Additional Comments. Am. J. Dis. Child. **43:** 705–708, March 1932.

7. HOLT, L. EMMETT, AND HOWLAND, JOHN: In Holt's Diseases of Infancy and Childhood, 11th ed., revised by L. EMMETT HOLT AND RUSTIN MCINTOSH, New York, D. Appleton-Century Co., pages 634–637.

A Simple Fluoroscopic Method of Foreign Body Localization[1]

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THE FUNDAMENTAL principles of different methods of foreign body localization were nearly all set forth within a few years after the original discovery of x-rays. The extensive literature on the subject since then has dealt chiefly with modifications or refinements of technic to overcome some shortcoming or to fill some special need. (For a summary and bibliography see the appended references.)

Practically all of the fluoroscopic methods either have been developed for the purpose of facilitating work in a military hospital or require special apparatus or attachments, or some preliminary calibration. There is need for a simple method which can be used in civilian laboratories employing only the materials generally at hand and without any special arrangements or preparatory adjustments or settings of the apparatus. The method to be described here requires only a standard table fluoroscope and the ordinary parallel arm caliper used in most laboratories to measure patient thickness.

The method is a refinement of the parallax principle first described by Levy-Dorn in 1897 and elaborated during the last war by Jordan, Young, and Blaine, among others. It consists essentially of locating, with the movable blade of the caliper, a point alongside the patient which is in the same horizontal plane as the foreign body, and is based upon the fact that shadows of objects in the same plane are displaced to an equal extent when the fluoroscope is moved.

Since the movable arm of the common caliper is a blade an inch wide, some point on it must be defined which can be readily recognized on the fluoroscope. This is easily done by taping on the blade a small bit of wire, such as a bent paper clip, so that a point projects a fraction of an inch beyond the end of the bottom edge of the blade. It is the tip of this wire that is to be positioned in the same plane as the object to be localized.

The localization is performed in two steps: (1) Position the tip on the caliper in the same transverse plane (perpendicular to the table top) as the object. (2) Raise the caliper arm until it is in the correct horizontal plane (parallel to the table top), as shown by equal shift of the tip and object when the fluoroscope is moved. To do this, stand the caliper on the table alongside the patient, with the blade beneath the screen so that the tip can be seen when the fluoroscope is turned on. Because of limitations of space beside the patient on the table top, the caliper may have to be placed parallel to the patient, only the tip being used as a reference point, not the whole arm as a pointer. Move the caliper along beside the patient until the tip is in the same transverse plane as the foreign body; this can best be done by closing the shutters to a narrow transverse slit with the shadows of the object and tip just barely seen simultaneously (Fig. 1). Then open the shutters about two-thirds and move the fluoroscope until the shadow of one of the shutter edges just touches the shadow of the object. While holding the caliper standing where it was set in the first step, raise the movable arm until the shadow of the tip just touches the same shutter edge. The tip is then in the same horizontal plane as the object. The caliper can easily be read in the fluoroscopic-room light, and the dimension indicated is the distance of the object above the table top. The distance from the table to the top surface of the patient can be measured directly with the caliper, and the difference is the depth sought.

Necessary precautions are few and simple. The slit for transverse alignment should be as narrow as possible; final posi-

[1] Accepted for publication in March 1944.

tioning should be done with a slit so narrow that a slight change in the shutter closes off the x-ray beam entirely. The caliper must be firmly held in position while the shutter is opened, the fluoroscope moved for the second alignment, and the arm raised to final position. In making the final alignment, it is better to shift the fluoroscope in such a direction that the shutter edge toward the anode end of the tube is used, since in that way the focal spot is foreshortened and the shadow of the shutter is sharp, whereas if the edge toward the filament end is used the shadow is blurred and the accuracy of results impaired. An accuracy of 1 cm. in localizing the depth is easily achieved, and with reasonable care better than 0.5 cm. is not incompatible with speed.

This parallax method is not only rapid and sufficiently accurate for localizing gross fragments, but it uses only what is commonly available and is quite free of hazards making for inaccuracy or inconvenience. No special devices or attachments or cones are needed, and no locks or fixed shift for the screen. No mathematical computations, tables, or charts are used. No drawings are made. The distance between tube and screen or screen and table need not be known, nor the distance between the screen and patient, which is required with many methods and yet is not easy to get without some special arrangement. Since no measurement of shadow shift is involved, the screen need not be held at a fixed distance from the focal spot but may be lifted to any convenient position above the patient. It is not necessary to keep the screen parallel to the table, but it may tip or tilt in any direction without affecting the results. Finally, the method may be used equally well with a unit where the screen and tube move independently or with one in which they are attached and move together.

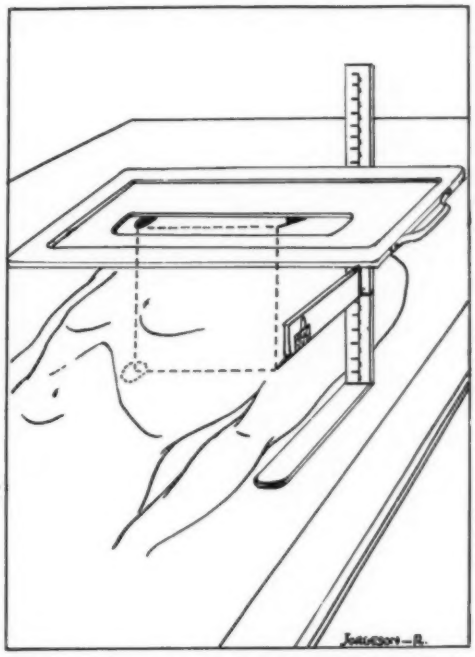

Fig. 1. The caliper stands on the table alongside the patient and is moved about until the tip on the blade is in the same transverse plane as the foreign body.

Caution: With equipment where tube and screen move independently, be sure the x-ray beam is always *entirely* on the screen, as otherwise the observer is subjected to excessive irradiation. If mobile or portable equipment is used, the patient's nearest skin surface should be at least 10 to 12 inches from the target of the tube, else the patient will be excessively irradiated. As with all fluoroscopic procedures, one must be sure the established safe exposure time for the patient is not exceeded.

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REFERENCES

CASE, JAMES T.: A Brief History of the Development of Foreign Body Localization by Means of X-Rays. Am. J. Roentgenol. **5:** 113, 1918.

REID, EDWARD K., AND BLACK, LAWRENCE F.: Foreign Body Localization in Military Roentgenology. Radiology **31:** 567, 1938.

Clinico-Pathological Conference

G. E. HAGGART, M.D., and HUGH F. HARE, M.D.
Lahey Clinic
and
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New England Deaconess Hospital

A salesman, aged 33 years, was admitted to the Clinic on Sept. 7, 1943, because of a tumor of the right thigh of two years' duration, with some resultant disability involving the right thigh and slight discomfort at times but no severe pain. He noticed a gradual increase in the size of the tumor one year before entry. There had been a loss of 12 pounds in weight but this had been regained. The patient had been given Coley's fluid elsewhere in July 1943. He also received 1,000 roentgens of radiation therapy elsewhere, in divided doses. No other therapy was given.

Physical examination revealed a well developed, stocky adult in good general health. In the right inner upper thigh was a large mass, about 12 cm. in diameter, attached to the deep structures of the pelvic arch but not to the femur. Over this area the skin showed some brown pigmentation but it was not fixed to the mass. There was increased local temperature. There was no marked enlargement of the inguinal nodes, and no limitation of hip motion except adduction when the tumor impinged on the perineum.

G. E. Haggart, Sept. 7, 1943: Diagnosis: Sarcoma of the inner proximal right thigh —type to be determined.

The mass is about the size of two large fists, dome-shaped, located in the proximal medial thigh compartment in the adductor area and extending from the midperineal area anteriorly to the midanterior line of the thigh and about the same distance posteriorly and distally. An attempt should be made at excision, with the distinct understanding on the part of the patient that it may not be successful so far as recurrence is concerned. I told him quite frankly that I thought he had a sarcoma—

Fig. 1. Roentgenogram showing tumor of right thigh (Aug. 3, 1943).

which I defined as a malignant lesion—that the prognosis was distinctly uncertain, but that I believed if he continued without treatment an ulcer would eventually develop as a result of circulatory failure in the tumor, in which event he would be in a very difficult and extremely unpleasant situation.

The patient is to have roentgenograms of the lungs, which I would expect to be negative in view of the long duration of the

mass and the fact that it has not increased greatly in size. He has no pain. He is to return home and talk to his physician and family and let us know what he will do. The possibility of radiation treatment depends on the results of histologic examination of the tumor.

[On the advice of his local physician (Sept. 12, 1943), the patient decided he would not be operated upon. He received no further treatment at this time. In February 1944 he wrote stating that he was disabled because of increasing pain, and asked to be admitted to the hospital

Fig. 2. Roentgenogram showing increase in size of tumor (March 30, 1944).

Hugh F. Hare, Sept. 8, 1943: Roentgenograms of the right femur and hip taken elsewhere (Barre City Hospital, Barre, Vermont) April 20, 1943, and a second roentgenogram taken August 3, 1943 (Fig. 1), show a large soft-tissue mass in the medial aspect of the right thigh proximally. Apparently the mass is connected with a lesion involving the descending ramus of the ischium, which shows a heaping up of new bone around it, probably a pathological fracture. There has been some increase in the amount of calcific material since April, and there has been a definite increase in the size of the mass. Probably the tumor is an osteochondrosarcoma. Chest roentgenograms should be taken.

for whatever treatment we thought advisable. He therefore went into the New England Deaconess Hospital on March 28, 1944.]

G. E. Haggart, March 30, 1944: This man returns because severe pain has developed in the upper inner left thigh. He has been unable to work the past two months and is now willing to submit to any type of treatment.

Examination shows an appreciable increase in the size of the mass in comparison to its size when I last saw him. It is very hard and fixed to the inferior pubic ramus. Furthermore, the mass extends posteriorly into the lower inner buttock, bulges medially against the rectum, and

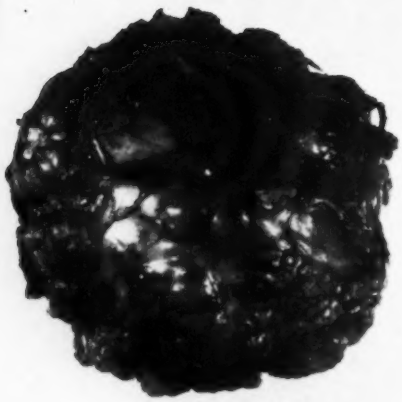

Fig. 3. Tumor removed.

extends anteriorly to the anteromedial border of the thigh. Distally, from the pubic bone, the mass is about 18 cm. in length down the thigh. Roughly spherical, it measures approximately 14 cm. in diameter. Doctor Lahey notes that on examination the mass is found to extend well up within the pelvis.

The roentgenograms taken on admission (Fig. 2) show changes which I think are most compatible with a chondrosarcoma. Roentgenograms of the lungs are negative for metastases. In view of these findings, palliative surgery is considered unwise. Chordotomy is to be considered.

Diagnosis: Chondrosarcoma, slowly growing but definitely malignant, of the upper inner right thigh and adjacent pubic and ischial rami.

J. H. Marks, March 29, 1944: A roentgenogram of the chest shows the lungs to be clear. Cardiac and diaphragmatic shadows appear to be normal. Roentgenograms of the pelvis and right thigh show a soft-tissue mass which apparently arises near the junction of the right pubis and ischium. This mass measures about 14 × 17 cm. It extends both anteriorly and posteriorly, and its posterior portion extends upward so that it displaces the lower rectum to the left of the midline. Its upper limit is at the level of the ischial spine. The major portion of the tumor is of homogeneous density, but there is an irregular mass of bone near its point of attachment to the pelvis. This bony mass measures only about 5 cm. in diameter.

Impression: The findings are probably those of an osteochondroma; the large proportion of cartilage suggests that it is probably malignant.

G. E. Haggart, March 31, 1944: Doctor Poppen has seen the patient and agrees that a chordotomy can be considered if we decide that excision of the mass should not be attempted.

[At a meeting of the Tumor Clinic, it was decided to attempt radical removal, for the following reasons:

1. Ulceration of the thigh over the mass was certain to occur in the near future.
2. In view of the pressure on the rectum from the growth of the tumor, obstipation was certain, requiring cecostomy.
3. The mass roentgenographically appeared encapsulated and, even though malignant, might possibly be removed *in toto*.

Against radical surgery, the following points were considered:

1. The tumor was large and, if it were removed, the remaining blood supply might not be adequate for healing of the wound.
2. The location of the tumor, with its proximity to the rectum and major vessels, made the surgical approach extremely hazardous.

Ligation of the internal iliac artery, as suggested by Doctor Lahey, before attempting radical removal was deemed necessary to prevent hemorrhage at operation.]

G. E. Haggart, April 10, 1944: Operation was done in two stages, the first, ligation of the right hypogastric artery, by Doctor Cattell. Through a right rectus incision, the peritoneum was opened, the bowel retracted and the bifurcation of the abdominal aorta exposed with particular reference to the right external and internal iliac artery. The ureter was clearly visualized and preserved. A heavy silk ligature was passed around the hypogastric

(internal iliac) artery and tied tightly. The wound in the peritoneum was closed, as was the abdominal wound, by the usual technic.

Anesthesia: Pontocaine, spinal fractional; ether, semiclosed; cyclopropane, carbon dioxide absorption; pentothal, intravenous; cocaine, topical.

The patient was then placed on his left side, at which time the blood pressure dropped sharply, but this was controlled satisfactorily by the anesthetist. An incision was made in the distal medial portion of the right buttock directly over the ischiorectal fossa and extended down, slightly laterally, over the proximal inner thigh. Following division of the subcutaneous fat, the ischiorectal fossa was exposed. The tumor protruded well up into and, in fact, practically filled, the fossa, and was pressing directly against the rectum. From this area, the mass extended down into the proximal posterior medial and anteromedial thigh and laterally as far as the shaft of the femur. There was a lateral prolongation of the tumor on the external aspect of the bony pelvis covering the obturator foramen, extending medially as far as the symphysis.

The tumor was covered by a heavy, dense capsule except for that part within the pelvis which, while invading the adjacent musculature, consisted of a series of lobules with a thin, fibrous envelope. The tumor arose from a single stalk at the junction of the pubic and ischial rami and lay beneath the medial hamstring muscle group, extending laterally, medially, and anteriorly in this same plane. The quadratus femoris muscle was spread out over its surface and had to be entirely sacrificed.

Fig. 4. Roentgenogram taken after operation.

The hamstring muscles were detached from the ischial tuberosity and adjacent ischium and pubis. The site of origin of the mass as described was then removed *en bloc*. By blunt dissection, the tumor within the ischiorectal fossa was delivered and removed. Following this, the skin,

subcutaneous, and muscle incisions were extended somewhat medially and, by further blunt dissection, the entire mass was delivered from the proximal and anterolateral portion of the thigh. Considerable difficulty was encountered in dissecting the capsule of the tumor from the lateral aspect of the ascending pubic ramus and symphysis, to which it was firmly adherent.

The part of the tumor in the thigh was removed as one specimen. The sacrotuberous ligament was preserved and the sciatic nerve identified and protected from injury. It was necessary to divide numerous branches of the pudendal nerves and to clamp, tie, or coagulate the many hemorrhoidal and pudendal veins. Hemostasis was obtained, and two Penrose tube drains were inserted, one in the ischiorectal fossa, the other in the large space the tumor had occupied over the lateral aspect of the pubic and ischial rami, and brought out through a separate stab incision. The hamstring muscles were reattached to the ischiorectal tuberosity, ischial and pubic rami, and the remaining superficial tissues were closed with interrupted sutures.

During operation, the patient received a transfusion of 500 c.c. of blood. His general condition throughout the procedure was good.

The impression obtained from visualization and removal of this large mass, which measured about 25 × 15 cm., was that it was a benign lesion.

Diagnosis: Osteochondroma, very large, question of malignancy, arising from the junction of the right ischial and pubic rami, filling the ischiorectal fossa and extending down into the posterolateral, medial, and anteromedial thigh.

Postoperative Course: Convalescence was uneventful; the wound healed by first intention.

Clinical Diagnosis: Osteochondrosarcoma.

Roentgen Diagnosis: Osteochondrosarcoma.

Operative Diagnosis: Osteochondroma.

Microscopic Diagnosis: Osteochondrosarcoma.

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CASE REPORTS

Cardiospasm[1]

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Cardiospasm usually presents a clinical picture characterized by epigastric pain or discomfort, dysphagia, and regurgitation of food. No difficulty is encountered, as a rule, in establishing the clinical diagnosis and the roentgenographic confirmation. Cases have been reported, however, in which the symptoms were obscure or the real diagnosis was masked by pulmonary complications.

In a case of cardiospasm recently seen by us there were no noticeable symptoms; pulmonary complications were present, and a mediastinal mass was found which was not explained until fluoroscopic examination was made of the esophagus, with barium.

Shelburne (6) reported a case of cardiospasm in which the dilated esophagus was thought to represent a mediastinal abscess. There was only a slight degree of dysphagia, which contributed to the error in diagnosis. Mitchell (4) cited several cases from the literature in which the dilated esophagus was mistaken for a mediastinal tumor. One of these cases was subjected to roentgen therapy to the mediastinum on the basis of the mistaken diagnosis. Mitchell also quoted a case, reported by Schmidt, in a six-year-old girl with a diagnosis of aspirational pneumonitis, which could not be controlled until dilatation of the esophagus had been carried out. Another case was reported in which for ten years the diagnosis had been pleuritis mediastinalis, because the condition was associated with periodic attacks of fever and pulmonary symptoms. Sampson (5) reported one case in which the presenting symptoms were referable to a lung abscess due to esophageal overflow, associated with the cardiospasm.

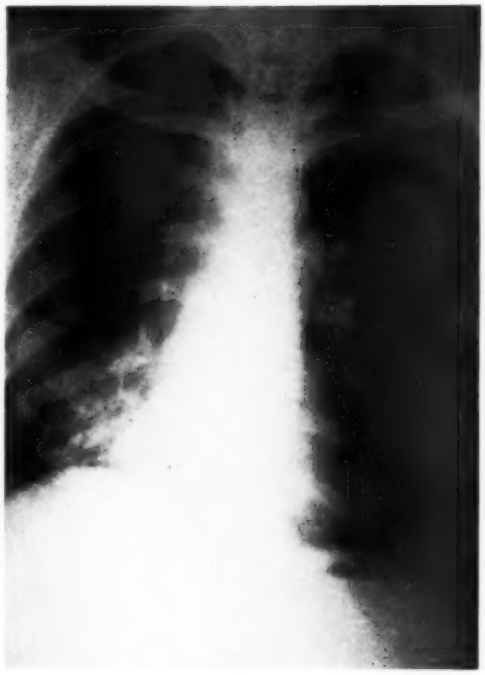

Fig. 1. Roentgenogram showing aspirational pneumonitis due to esophageal overflow in the right lower lobe, limited by the interlobar septum above. The right diaphragm is elevated, indicating atelectasis. The mediastinal mass representing the dilated esophagus, extending to the right, can be seen.

CASE REPORT

A 26-year-old colored male was admitted to the Fort Bliss Station Hospital on Aug. 31, 1942, with a diagnosis of acute gonorrhea of two weeks' duration. He had also an acute upper respiratory infection of four days' duration.

Except for slight injection of the nasopharynx and the urethral discharge there were no abnormal findings on physical examination. The admission temperature was 100° F., the pulse rate was 78, and the respiration was 18 per minute. The Kahn test was negative. Blood studies revealed no anemia. The urine contained pus and gram-negative diplococci.

The gonorrheal infection was controlled with oral chemotherapy and the temperature returned to normal within twenty-four hours and remained normal throughout the patient's stay in the hospital.

[1] From the Roentgenological Service, Station Hospital, Fort Bliss, Texas. Accepted for publication in January 1944.

Fig. 2. Roentgenogram showing the barium-filled dilated, tortuous esophagus. The constriction of the cardiac portion is clearly seen.

Fig. 3. Roentgenogram taken after amyl nitrite inhalation, showing barium in the dilated stomach, with some remaining in the esophagus.

On account of the respiratory infection, the possibility of pneumonia was considered and x-ray examination requested. A roentgenogram of the chest, Sept. 3, showed changes in the right lower lung field, considered to be pneumonia, and a mediastinal mass extending toward the right, which was not explained.

The patient made an uneventful recovery and further roentgenographic studies were made. Fluoroscopic examination with barium showed the dilated esophagus, with obstruction at the cardia, thus establishing the diagnosis of cardiospasm (Fig. 2). With the dilated esophagus filled with the barium solution, the patient was given an inhalation of amyl nitrite. Fluoroscopically, a partial relaxation of the cardia was observed and some of the solution passed into the stomach; a large amount of barium, however, remained in the esophagus (Fig. 3).

At a later date a routine check-up chest examination was made and a small patch of unsuspected aspiration pneumonitis was observed in the lower lung field. The patient presented no symptoms at this time that would lead one to suspect the disease in the left lung.

On careful questioning, the patient admitted that for five or six months he had experienced a discomfort or a sense of fullness on drinking or eating, for which he had consulted physicians on two different occasions. He had discovered that after eating a full meal the discomfort could be relieved by voluntary vomiting and at times he had raised blood with the vomitus. He had lost about fifty pounds in weight during the past year. He denied any undue coughing and there had been no strangling spells.

DISCUSSION

Roentgenologically, the typical case of cardiospasm offers no diagnostic difficulties when properly examined. On the roentgenogram, without barium in the esophagus, there is usually seen in the advanced case a wide supracardiac shadow, projecting to the right and suggesting a mediastinal mass or cardiac enlargement (Fig. 1). Fluoroscopic examination with barium suspension in the esophagus is, of course, essential. The case recorded here again

illustrates the importance of studying the barium-filled esophagus in the presence of obscure changes in the mediastinum and the medial portion of the lungs. Fluoroscopy and a roentgenogram with barium in the esophagus revealed the dilated esophagus filled with fluid and food particles. At the esophageal orifice there was a constriction with only a trickle of barium passing into the stomach. With the inhalation of amyl nitrite, the cardia relaxed and a portion of the esophageal contents passed into the stomach. The degree of relaxation and the amount of esophageal contents passing into the stomach will vary with the stage of the disease. This is an important procedure in the differential diagnosis of cardiospasm and carcinoma, since in the latter, because of the infiltration, there will be no relaxation of the cardia. Kornblum and Fisher's (3) report of 3 cases of dilated esophagus with carcinoma emphasizes the importance of a careful study and, also, some of the difficulties encountered in a differential diagnosis, particularly in the older age group.

SUMMARY

A case of cardiospasm is presented with several features of interest:

1. Symptoms were not sufficiently appreciated by the patient to cause him to impress upon the physicians who previously examined him the necessity for x-ray examination.

2. There developed an aspiration pneumonitis, undoubtedly due to an esophageal overflow and aspiration of some of the esophageal fluid. Thus, the pulmonary complication prompted further investigation and the roentgenographic studies disclosed the condition.

3. The true nature of the mediastinal mass was not determined until the esophagus was studied fluoroscopically with a barium mixture.

4. The importance of fluoroscopic studies of chest conditions, particularly with barium paste in the esophagus, is again emphasized.

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REFERENCES

1. BEHREND, A.: Cardiospasm: Report of Unusual Case. Proc. Staff. Meet., Mayo Clin. **11:** 555–556, August 26, 1936. (Quoted by Mitchell.)

2. DE VEER, A.: Hochgradige Ösophagusdilatation: 10 Jahre unter der Diagnose Pleuritis mediastinalis. Med. Klin. **33:** 439–440, March 25, 1937. (Quoted by Mitchell.)

3. KORNBLUM, K., AND FISHER, L. C.: Carcinoma as a Complication of Achalasia of the Cardia. Am. J. Roentgenol. **43:** 364–376, March 1940.

4. MITCHELL, HORACE E.: Achalasia of the Esophagus: with Report of a Case Relieved by Esophagogastrostomy, Ann. Otol., Rhin. & Laryng. **50:** 662–674, September 1941.

5. SAMPSON, D. A.: Lung Abscess Due to Esophageal Overflow. New England J. Med. **219:** 982–985, Dec. 22, 1938.

6. SHELBURNE, S. A.: An Unusual Case of Cardiospasm. J. A. M. A. **102:** 285–286, Jan. 27, 1934.

7. STARLING, H. J., AND CAMPS, F. E.: Two Cases of Achalasia of the Cardia with Severe Pressure Symptoms. Guy's Hosp. Rep. **85:** 201–206, April 1935. (Quoted by Mitchell.)

Aberrant Pancreatic Tumor in the Duodenal Wall[1]

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According to Ewing, the duodenum is the common site for aberrant pancreatic tissue, which infrequently gives rise to a new growth. Such a case has recently come under our observation. Because of the rarity of the lesion and the interesting x-ray findings, we believe that it merits a detailed report.

Mrs. I. S., age 64, was admitted to the Jewish Hospital on Dec. 10, 1942, because of pain in the abdomen, loss of appetite, "sour stomach," and frequent vomiting during the preceding two months. The physical examination revealed no palpable masses in the abdomen. There was some tenderness in the region of the epigastrium upon deep pressure. Clinical laboratory studies showed nothing remarkable.

A complete x-ray study of the gastro-intestinal tract was carried out. A plain view of the abdomen showed no dense shadows in the region of the gallbladder suggestive of stones. After the oral administration of tetraiodophenolphthalein sodium dye the gallbladder failed to fill. A barium-meal study showed the stomach to be of normal size and shape without filling defects. The bulb was of normal size and shape, containing both barium and gas

[1] From the Departments of Roentgenology and Pathology, the Jewish Hospital, Cincinnati, Ohio. Accepted for publication in November 1943.

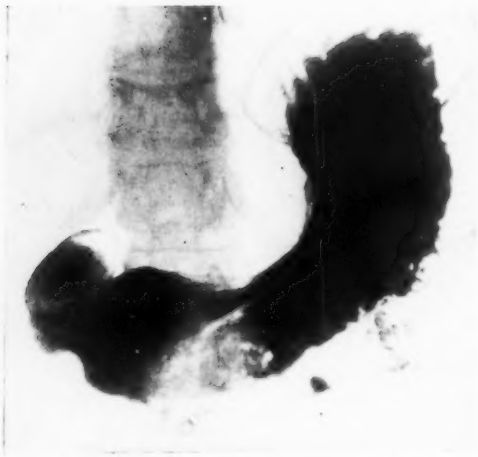

Fig. 1. Aberrant pancreatic tumor in the duodenal wall. Barium study, showing normal appearing stomach and bulb of normal size and shape.

(Fig. 1). In the right lateral position the stomach and duodenum were found to be in normal relation to the surrounding structures, with the duodenal loop outlined through its entire course; the unusual feature was that the latter contained gas with only a little of the barium mixture irregularly distributed in its lumen (Fig. 2). On the following day only a small amount of barium was observed in the colon, the rest having been vomited shortly after examination. A barium enema revealed no obstruction or deformity in the entire course of the colon. The diagnosis was a probable gallbladder lesion.

Ten days later re-examination of the gallbladder following intravenous injection of tetraiodophenolphthalein revealed a uniform filling of only moderate density. In the right lumbar region was a large oval pocket containing gas, apparently in the duodenum, a rather unusual finding in the absence of gas in the stomach (Fig. 3). A second barium-meal examination again revealed a stomach of normal size with a markedly dilated duodenum ending abruptly at the inferior angle (Fig. 4). In the right lateral position the ascending portion of the duodenum presented a contour deformity encroaching upon its lumen, apparently causing stenosis (Fig. 5). Since the deformity appeared to be within the duodenum, an extrinsic lesion was excluded and the diagnosis of a new growth originating in the duodenum was made.

The patient was operated upon and a tumor, which was readily located in the ascending portion of the duodenum, was resected. When the resected segment was examined a true stenosis of considerable degree was found, apparently due to an obvious palpable mass involving the wall. The mucosa was essentially normal. Its only abnormality was a minute area of reddish flecking that extended toward the tumefaction in the wall.

Microscopic studies of the mass in the duodenal wall showed a new growth arising from pancreatic tissue. Since the pancreatic tissue of the head, which was attached to the ascending loop of the duodenum, was free of tumor formation, it was concluded that the new growth originated from aberrant pancreatic tissue in the duodenal wall. Furthermore, the character of the tumor strongly suggested that the aberrant tissue was ductal in origin.

CONCLUSION

A case of a tumor in the duodenal wall arising from an aberrant pancreas is reported. X-ray examination made possible localization of the new growth in the ascending portion of the duodenum.

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REFERENCE

(1) Ewing, James: Neoplastic Diseases. Philadelphia, W. B. Saunders Co., 1928.

Direct Current Combined with X-Ray Therapy: Case of Kaposi Sarcoma Thus Treated[1]

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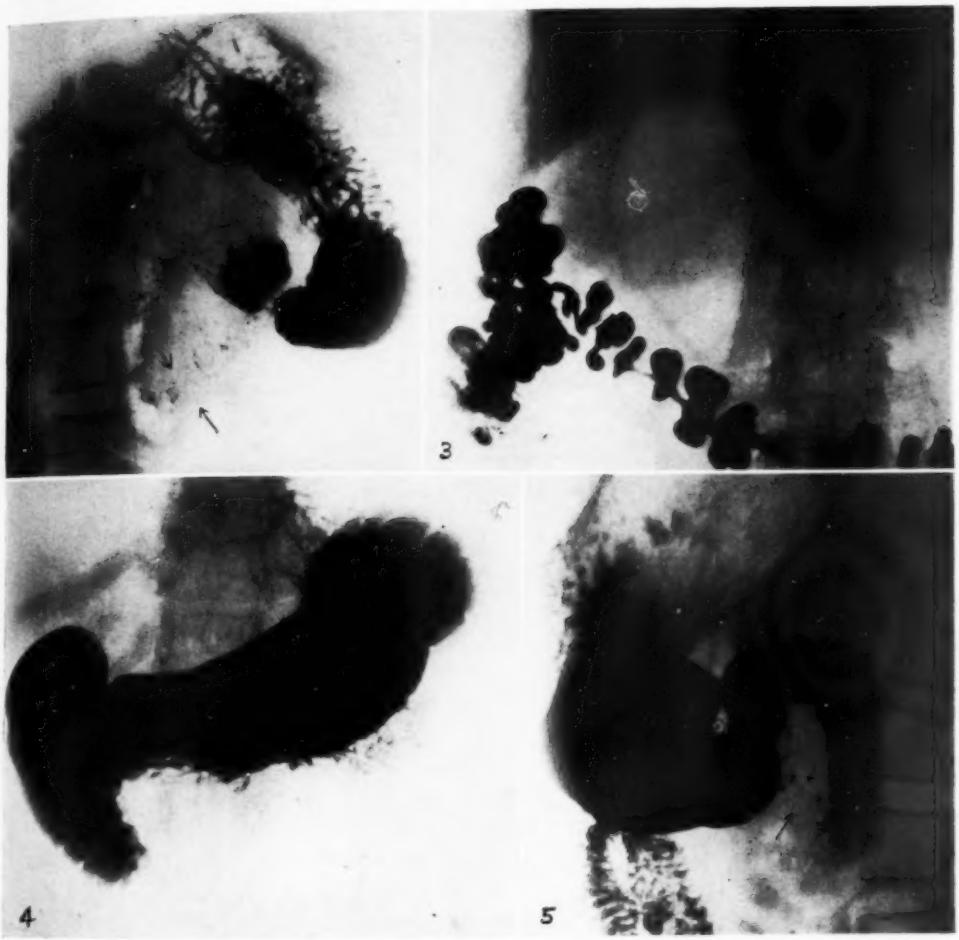
The use of direct current in combination with x-ray therapy in order to increase the efficacy of the latter has not been reported, although it has been known for some time. Our basis for this procedure is of necessity, therefore, purely theoretical.

In the case to be reported treatment was given with the following x-ray therapy factors: 120 kv.p., 5 ma. filament current, 4 mm. Al filtration, 25 cm. distance. The output of the apparatus was 15 r per minute. Each area received a total of 1,500 r. The electrical apparatus consisted of an ordinary galvanic machine and a pair of electrodes made of felt pads soaked in normal saline. The positive electrode was placed over the tumor area and the negative electrode over a nearby area, so that

[1] From the Department of Dermatology of the College of Medicine of the University of Cincinnati. Accepted for publication in December 1943.



Figs. 2–5. Aberrant pancreatic tumor in the duodenal wall. Fig. 2. Right lateral view showing only a small amount of barium in the duodenal loop, irregularly distributed in its lumen. Fig. 3. Gas-filled pocket in the right lumbar region. Fig. 4. Normal stomach and dilated duodenum. Fig. 5. Right lateral view showing contour deformity of ascending portion of the duodenum and stenosis.

the lines of force would travel as directly as possible through the region of the tumor. The positive electrode was made as small as possible but large enough to cover the entire tumor area. The purpose of this arrangement was to produce the greatest possible current density at the site of the lesion. The x-rays were directed through the positive electrode into the tumor area. The plan followed was to give direct current first for about ten minutes, then to begin x-ray irradiation while the current was still on and continue both until the desired x-ray dose (150 r) had been delivered. Direct current was applied to the limit of tolerance as judged by the sensation of pain or discomfort.

V. R., a 67-year-old Italian tailor, was admitted because of edema of the left lower extremity and widespread involvement of the skin by the bluish tumors characteristic of hemorrhagic sarcoma. The patient had first noticed these lesions about five years prior to admission.

Examination showed a brawny edema of the left lower leg and foot with purplish discoloration of the skin of that area. On the left plantar surface were numerous hemorrhagic verrucous lesions. The right foot also showed diffuse involvement by lesions of

Figs. 1 and 2. Idiopathic hemorrhagic sarcoma of Kaposi showing arm and forearm lesions before and after treatment. After the combined treatment the lesions on the forearm show flattening and increased pigmentation as compared to the results of simple radiation of same dosage (1,500 r) to the upper arm lesion (three weeks after treatment).

the hemorrhagic type, but this foot was not indurated or swollen. The right hand and wrist were edematous and indurated and several small hemorrhagic nodules protruded from the skin on the dorsum of the wrist. Scattered widely on different areas of the body were numerous circinate areas of purple color. Each area was made up of confluent groups of small, round, firm subcutaneous hemorrhagic nodules which faded only slightly on pressure.

The patient was studied completely for systemic involvement, and all laboratory findings were negative, including blood serologic tests. Biopsy of lesions similar to those treated revealed a picture characteristic of hemorrhagic sarcoma of Kaposi, showing dense new capillary formation with increased cellular infiltrate, the so-called second phase of this type of tumor.

On Jan. 25, 1943, two areas on the patient's right arm (Fig. 1) were selected for treatment. The upper arm lesion, which measured 2 × 3/4 in. and was fairly prominent, was used as a control, being treated with routine x-ray therapy, with factors as indicated above. The more prominent forearm area, which measured 3 3/4 × 1 1/2 in. and protruded above the level of the skin, was given the combined therapy.

Ten daily treatments were given to each area. The following progress notes were recorded.

Feb. 5: Definite area of erythema present over right forearm, more marked than over upper arm area (control area).

Feb. 16: Intense erythema of forearm area evident and fading erythema on upper arm area. Both lesions have decreased appreciably in size.

Feb. 23: Erythema of forearm fading but still marked. Forearm lesion flatter and fading out. Upper arm lesion also is fading out; no erythema.

Feb. 28: Erythema of forearm almost gone. Forearm lesion is still receding (Fig. 2). There is no further decrease in size of upper arm lesion.

March 14: Erythema of forearm area has disappeared. Lesion has receded still more since last time. It is completely flattened out and only a faint discolored area remains. Upper arm area is about the same as on previous examination.

March 27: Right upper and lower arm lesions show no change. The amount of regression in the lesions is hard to compare. At present each appears much the same as before.

On Feb. 5, 1943, two more areas were chosen to study the comparative effects of the two methods. A lesion of the left upper thigh (Fig. 3, B) was selected as the control area, and one on the right hip (Fig. 3, A) as the experimental area. Both lesions were of about the same size, measuring 2 3/4 × 2 inches and 2 3/4 × 1 1/4 inches, respectively. Both were equal in prominence as judged by induration and protrusion beyond the skin level, and both appeared clinically to be in the same phase. The total x-ray dosage and the size of the portal were the same in each case. The patient was co-operative, and treatments were given daily according to the routine described above. The following progress notes were recorded.

Feb. 14: Erythema on hip (combined therapy). No erythema on control area.

Feb. 23: Erythema on hip is marked while that of thigh is fading. Lesions appear unchanged in size.

Feb. 28: Erythema of hip area is now intense (Fig. 3, C) and vesicular. Lesion is obliterated by the intense reaction. There is no erythema of left thigh area and lesion appears slightly flattened and less pronounced (Fig. 3, D).

March 14: Erythema of hip is fading but still evident. Only a faint outline of the lesion is present. Left thigh area shows no erythema. Lesion is still very prominent, but appears smaller and flatter.

March 27: Hip exhibits little evidence of any lesion (Fig. 3, E). Erythema is gone. On the left thigh, the residual lesion is still present (Fig. 3, F).

COMMENT

Evaluation of the comparative effects of the two types of treatment on the arm areas was made difficult by the difference in the size and relative prominence of the lesions and the difference in size of the tube

Fig. 3. A. Right hip area before treatment. B. Left thigh area before treatment. C. Right hip area ten days after combined treatment was completed (1,500 r), showing intense erythema. D. Left thigh area taken at same time as C, showing slight erythema following x-ray therapy alone. E. Right hip six weeks after combined treatment was completed, showing slight residual. F. Left thigh area taken at same time, as E, showing definite residual reaction.

portals. Even though the experimental area was larger to start with and more prominent, it still showed some greater degree of recession than did the control area. The second pair of lesions was more satisfactory for comparison because, as noted above, the areas were of about the same size and prominence, and the size of the portals was exactly the same. In this pair, a much greater amount of residual disease was noted in the control area than in the experimental area.

Although this case was very suitable for our experimental purposes because of the multiplicity of similar lesions, the characteristic radiosensitivity of the tumors was a handicap, since the control areas could be expected to respond to x-ray alone and the differences in response would be difficult to measure. However, certain appreciable differences did emerge from the two types of treatment. First, the skin erythema produced by the combined treatments appeared earlier, was much more intense, and persisted longer. This may have been due to the fact that D.C. therapy produced electrolytic effects near the electrode, and this, plus skin irritation, caused a hyperemia which increased scattering and thus increased the effects of irradiation. On the other hand, these differences may be due to the increase in radiosensitivity by prolongation of ionization. This, of course, will require further study. Second, the experimental combined treatment areas showed a greater response than did the control areas.

Although I have employed this combination of direct current and x-rays in four other types of malignant tumor since 1937, none of these was studied as completely as this case of hemorrhagic sarcoma of Kaposi.

CONCLUSIONS

A case of hemorrhagic sarcoma of Kaposi was treated by x-ray therapy combined with local galvanic current to the lesion. In spite of the radiosensitivity of these tumors, it was possible to detect definite differences in the erythema produced by and the clinical response to the combined treatment as compared with control lesions treated by x-ray therapy alone.

NOTE: The author is grateful to Dr. H. L. Claassen and Dr. Leon Goldman for their help and encouragement, to Dr. Anthony C. Cipollaro for his critical review and suggestions for future studies, and to Dr. Ira I. Kaplan, under whose direction this project was started.

Cincinnati General Hospital
Cincinnati 29, Ohio

EDITORIAL

Howard P. Doub, M D., Editor

John D. Camp, M.D., Associate Editor

Anesthetics Used in Connection with Roentgenology

Only occasionally is the anesthetist faced with the necessity of administering an anesthetic agent while roentgenologic equipment is in use and sparks are therefore being generated. When such a necessity arises in the hospital, it is usually either in the operating room or the roentgenologic laboratory. Whatever the situation in the hospital, the anesthetist is always aware that where there is a spark there is danger of explosion. Such a disaster is so serious that no avoidable risks of it should be taken and no possible precautions against it omitted (1, 2, 3). The precautions are both positive and negative.

Among the negative measures, the first can be stated in the form of a rule: No inflammable anesthetic agent should be administered in a room where roentgenologic equipment is being used. Accordingly, some of the commonly employed agents that should *not* be used near "live" roentgenologic equipment include ether, alone or in combination with any other gas, ethyl chloride, and cyclopropane. Moreover, use of chloroform in these circumstances is not advised, although that agent is not inflammable. The darkened condition of the room makes it impossible to observe the patient well.

Of the positive safety measures, perhaps the first is the following: When roentgenologic equipment is brought into the operating room, the regular machine for administering nitrous oxide, which is equipped with an ether bottle, should be removed from the room and a special nitrous oxide-oxygen machine, not equipped with an ether bottle, should be substituted. This same special machine is the one to be used in the roentgenologic laboratory if nitrous oxide is to be administered.

Further positive measures have to do with the choice of agent or method and, in some cases, with dose and technic. Some years ago it was not easy to find a safe anesthetic agent or method for use when roentgenologic equipment had to be employed. The range of choice was limited. Now, however, the range of choice is wide, and there is no good excuse for departing from safe principles. Where roentgenologic equipment is in use, therefore, local, regional, spinal, or intravenous methods of anesthesia may be employed, with agents appropriate to these methods; if it is desirable to employ the inhalation method, the agent should be nitrous oxide, combined with oxygen but without ether. Preliminary medication also is desirable. With morphine or atropine given by hypodermic injection and pentobarbital sodium (nembutal) given by mouth, it is possible to control the patient by means of nitrous oxide and oxygen, without ether. An additional agent and method come up for consideration when a child who has aspirated a foreign body into the trachea is to be subjected to bronchoscopy. Under these circumstances solution of tribromoethanol (avertin with amylene hydrate) is administered by rectum, the usual dose being 100 mg. per kilogram of body weight. Preliminary medication is not used in such cases.

Because of the current favor in which intravenous anesthesia is held, it merits special consideration. Intravenous anesthesia may be used where roentgenologic equipment is employed, but the agent

must be given in small doses so that the patient's invisible breathing can be heard and anoxemia eliminated in so far as possible. Intravenous anesthesia, nitrous oxide 50 per cent and oxygen 50 per cent, and preliminary medication, make a safe combination that may be used under practically all circumstances. Probably this is the method of choice for use under the circumstances here discussed.

REFERENCES

1. Clark, L. H.: Some Dangers Involved in the Use of Anaesthetics in X-Ray Departments. Radiography **10:** 25–27, April 1944.
2. Current Comment: Recommended Safe Practice for the Use of Combustible Anesthetics in Hospital Operating Rooms. Anesthesiology **2:** 580–586, September; 689–695, November 1941.
3. Hadfield, C. F.: Use of Anesthetics in X-Ray Departments. Radiography **10:** 17–23, March 1944.

John S. Lundy, M.D.
Mayo Clinic

CANCER TEACHING DAY

Tuesday, Oct. 17, will be observed as Cancer Teaching Day at Ithaca, New York, the program being presented under the auspices of the Medical Society of the County of Tompkins, the Medical Society of the State of New York, and the Division of Cancer Control of the New York State Department of Health.

At the afternoon session (4 P.M.) Dr. John H. Garlock of Mt. Sinai Hospital, New York City, will speak on Carcinoma of the Colon, and Dr. John J. Morton of Strong Memorial Hospital, Rochester, on Bone Tumors. The speakers at the evening session will be Dr. Andrew H. Dowdy, of the University of Rochester, on Epithelioma of the Skin, and Dr. Frank Adair of Memorial Hospital, New York City, on Carcinoma of the Breast.

OHIO RADIOLOGICAL SOCIETY

At the annual meeting of the Ohio Radiological Society, officers for 1944–45 were elected as follows: President, Clarence E. Hufford, M.D., Toledo; Vice-President, Harold G. Reineke, M.D., Cincinnati; Secretary-Treasurer, Henry Snow, M.D., Dayton. Ralph W. Holmes, M.D., of Chillicothe, and John Newton, M.D., of Cleveland Heights, were elected to the Executive Council.

PITTSBURGH ROENTGEN SOCIETY

The newly elected officers of the Pittsburgh Roentgen Society are as follows: President, William J. McGregor, M.D., Pittsburgh; Vice-President, James R. Gemmill, M.D., Monesson; Secretary-Treasurer, Lester M. J. Freedman, M.D., Pittsburgh.

INFORMATION FOR AUTHORS

RADIOLOGY has recently prepared a booklet of Information for Authors, including suggestions for improved illustrations. The Editor will be glad to send a copy of this, upon request, to anyone who anticipates contributing to this journal.

In Memoriam

RUDOLPH JEROME PRICE, M.D.
1895–1944

Dr. Rudolph Jerome Price of Dayton, Ohio, died on June 8th as a result of injuries sustained in an automobile accident. Doctor Price was born in Richmond, Indiana, in 1895. He was graduated from Earlham College in 1918 and from the University of Michigan Medical School in 1923. He received the French Croix de Guerre for his services in the First World War and had recently been appointed by the Army as a consultant at Wright Field. He was radiologist at the Good Samaritan Hospital, Dayton, and secretary of the Dayton Hospital Board.

Doctor Price was a diplomate of the American Board of Radiology and a member of the American College of Radiology, the American Roentgen Ray Society, and the Radiological Society of North America.

Frederick C. Martin

FREDERICK C. MARTIN
1884–1944

Radiologists throughout the country will learn with sincere regret of the death, on Aug. 20, after a prolonged illness, of Frederick C. Martin, manager of the Eastman Kodak Company's Medical Sales Division.

Mr. Martin was born in Philadelphia sixty years ago. He had been associated with the Eastman Kodak Company since 1916 and head of the Medical Sales Division since 1929. He was a familiar figure at gatherings of radiologists, where he presided as a genial host over the exhibits of the Eastman Kodak Company. To his technical knowledge and unfailing co-operation many in our specialty are deeply indebted. His helpful counsel and friendly service will be greatly missed.

Books Received

Books received are acknowledged under this heading and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

THE GASTRO-INTESTINAL TRACT. A HANDBOOK OF ROENTGEN DIAGNOSIS. By FRED JENNER HODGES, B.S., M.D., Professor of Roentgenology, University of Michigan Medical School, Ann Arbor, Michigan. A volume of 320 pages, with numerous illustrations. Published by The Year Book Publishers, Inc., 304 S. Dearborn St., Chicago, Ill. Price $5.50.

THE PRACTICE OF MEDICINE. By JONATHAN CAMPBELL MEAKINS, M.D., LL.D., Brigadier, Deputy Director General of Medical Services, Royal Canadian Army Medical Corps; Professor of Medicine and Director of the Department of Medicine, McGill University; Physician-in-Chief, Royal Victoria Hospital, Montreal; Formerly Professor of Therapeutics and Clinical Medicine, University of Edinburgh; Fellow of the Royal Society of Edinburgh; Fellow of the Royal Society of Canada; Fellow of the Royal College of Physicians, London; Fellow of the Royal College of Physicians, Edinburgh; Honorary Fellow of the Royal College of Surgeons, Edinburgh; Fellow of the Royal College of Physicians, Canada; Fellow of the American College of Physicians; Honorary Fellow of the Royal Society of Medicine. A volume of 1,444 pages, with 517 illustrations, including 48 in color. Published by the C. V. Mosby Co., St. Louis, Mo. Fourth Edition, 1944. Price $10.00.

Book Reviews

THE PATHOGENESIS OF TUBERCULOSIS. By ARNOLD R. RICH, M.D., Associate Professor of Pathology, The Johns Hopkins University School of Medicine, Baltimore. A volume of 969 pages; 35-page index; 89 figures; 20 tables; 1417 references; 4 charts. Published by Charles C. Thomas, Springfield, Ill. Price $10.50 postpaid.

In the course of clinical observations and experimental investigation a great wealth of data accumulates along with conclusions and deductions, some of which rest on safe grounds and others on questionable evidence and unjustified generalizations and extrapolations. The result is not infrequently a chaotic mass of statements, of contradictions and controversies. Many workers in the field of tuberculosis have felt that such a state of affairs has been reached in the most fundamental field of tuberculosis research concerning the pathogenesis of the disease. That this is so is obvious when it is recalled that primary infection is considered absolutely benign by some authors and potentially most dangerous by others; that it is believed by some to confer upon its bearer protection against later infection, while other workers claim that it increases the vulnerability to subsequent infections. Examples of such unsolved controversies could be multiplied.

Doctor Rich, with his associates, has contributed significant studies to the pathogenesis of tuberculosis since 1929. Even his first paper in this field questioned and attacked established concepts and gave evidence that he had critically approached his problems. One may assume that in the intervening fifteen years he has spent much time and thought in digesting past and current publications, in critically analyzing the data from the literature as well as his own experimental studies. The result is a monumental book in which the available knowledge has been scrutinized, probed, and resynthesized in a more thorough and searching manner than ever before. He has furnished a profoundly satisfying study of the problem. All factors operative in producing and modifying tuberculosis are carefully analyzed: the bacillus, as to its biochemical activities, its dosage and virulence; the host as to his native and acquired resistance against the background of environmental conditions.

The style is clear and lucid and this reviewer found the book stimulating and, at times, exciting. Doctor Rich takes many excursions away from tuberculosis into general pathological and biological principles; this adds validity and a broader interest.

The aim of this critical analysis was not, and could not have been, a definitive solution of all controversial matters and open problems. It was rather an attempt to bring order and clarity out of the existing chaos, to form plausible and consistent working hypotheses, to separate acceptable facts from non-acceptable fancy, to show clearly where knowledge is incomplete and where further study is necessary. This reviewer believes that Doctor Rich has in all essentials achieved his aims.

Controversy and disagreements will, of course, continue; but they may now proceed on a field that has been well cleared of worthless rubble; and the lines of possible controversy are better defined. In various phases of the problems one may arrive at somewhat different conclusions than Doctor Rich has reached. This, I believe, is mainly due to the fact that one may differ with him in regard to the emphasis he gives to certain sets of facts. Every worker naturally puts the greatest confidence in his own working tools. Doctor Rich's are those of experimental pathology. Others may feel, as does this reviewer, that evidence derived from clinical, roentgenological, and pathologico-anatomical work might well have been given more weight. If this had been done, the whole structure and content of this book would have provided many more obvious applications to practical work in tuberculosis. But there should be no mistake about this: anybody who is really inter-

ested not only in knowing the disease tuberculosis but in understanding it should read and study this volume. The most fundamental facts and interpretations of the mechanism of tuberculosis are here, even if the author does not always provide the few intervening steps between fundamentals and practice. If you think that understanding is a pertinent function of knowledge, you will want to read Doctor Rich's book.

TUBERCULOSIS OF THE EAR, NOSE, AND THROAT: INCLUDING THE LARYNX, THE TRACHEA, AND THE BRONCHI. By MERVIN C. MYERSON, M.D., New York City. A volume of 291 pages, with 89 illustrations. Published by Charles C Thomas, Springfield, Ill. Price, $5.50.

From an experience with over ten thousand cases of tuberculosis, Doctor Myerson has prepared this concise monograph. In the first half he discusses a thousand cases of tuberculosis of the larynx; the second half is devoted to tuberculosis of the ear, nose, oral cavity, tongue, tonsil, pharynx, esophagus, trachea, and bronchi.

In his Introduction the author states his purpose: "to bring up-to-date our knowledge of tuberculosis of the structures which come under the care of the otolaryngologist and bronchoscopist . . . to serve all those whose studies and interests encompass the field of tuberculosis of the upper and lower respiratory passages." He has produced a most practical volume for the busy specialist in the field of otolaryngology. It is well illustrated with drawings and photographs, and appropriate case histories are included.

ATLAS OF OVARIAN TUMORS. By GEMMA BARZILAI, M.D. New York City. Preface by FRED W. STEWART, M.D., Pathologist, Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City. A volume of 264 pages with 258 original illustrations, 45 in colors on 58 plates. Published by Grune & Stratton, 443 Fourth Ave., New York, N. Y. Price (cloth) $10.00.

Doctor Barzilai's Atlas of Ovarian Tumors is a clear, concise, well organized, and thoroughly illustrated loose-leaf handbook.

The consideration includes a comprehensive classification according to developmental and cyclic phases of the graafian follicle; structures traceable to the different stages of the development of the male gonad; structures traceable to the early mesenchymal core of the ovary; structures traceable to a totipotent cell; structures traceable to tissue normally found in the extrafollicular portion of the ovary; structures belonging to organs that are normally adjacent to the ovary; and lastly secondary tumors.

The subject matter on each tumor has a convenient marginal index indicating the comprehensive consideration of all the phases in which the clinician and pathologist might be interested. This uniform method of discussion with indexing is especially helpful for comparison of the various ovarian neoplasms.

The fifty-eight plates showing histologic structure are excellent and with the exact descriptions give the Atlas maximum teaching value. Every pathologist and every medical library will find frequent use for this contribution to the relatively new field of tumors of the endocrine glands.

PSYCHIATRY AND THE WAR. A SURVEY OF THE SIGNIFICANCE OF PSYCHIATRY AND ITS RELATION TO DISTURBANCES IN HUMAN BEHAVIOR TO HELP PROVIDE FOR THE PRESENT WAR EFFORT AND FOR POST WAR NEEDS. Edited by FRANK J. SLADEN, M.D., Physician-in-Chief, Henry Ford Hospital, Detroit, Michigan; Trustee, McGregor Fund. A volume of 505 pages. Published by Charles C Thomas, Springfield, Ill. Price $5.00.

This book is a carefully assembled record of the Conference on Psychiatry held at Ann Arbor, Michigan, October 22, 23, and 24, 1942, at the invitation of the University of Michigan and the McGregor Fund. The conference material is presented in five parts, which makes for ease of reference. The headings for the subject matter dealt with in each part are simple and explicit. Under the first head, "The Philosophy of Psychiatry," psychiatry is defined and its relation to psychology, medicine, surgery, pediatrics, and geriatrics is reviewed by leaders in psychiatric thought. Research in Psychiatry; Psychiatry in the Training, Experience, and Education of the Individual, and Psychiatry and the War are in turn painstakingly discussed. In part V follow two symposia which have for their purpose the synthesis and application of the thoughts expressed in the more formal presentations. The volume closes with an index of 49 pages which is sufficiently detailed to be of real reference value. A unique and helpful characteristic of the book is the epitomizing summary in terse words or phrases at the beginning of each of the formal articles. Incidentally, it may be remarked that the volume represents not only good editing but also good bookmaking.

This book, as a record of the thoughts and the judgments of many of the leaders in psychiatry and kindred fields, includes in its pages the dynamics for the formulation of thoroughgoing perspectives and the crystallizing of constructive attitudes. It merits thoughtful perusal by the serious minded, including physicians, educators, sociologists, administrators, and men of research.

RADIOLOGICAL SOCIETIES OF NORTH AMERICA

Editor's Note.—Will secretaries of societies please cooperate by sending information to Howard P. Doub, M.D., Editor, Henry Ford Hospital, Detroit 2, Mich.

UNITED STATES

Radiological Society of North America.—Secretary, D. S. Childs, M.D., 607 Medical Arts Building, Syracuse 2, N. Y.

American Roentgen Ray Society.—Secretary, Harold Dabney Kerr, M.D., Iowa City, Iowa.

American College of Radiology.—Secretary, Mac F. Cahal, 540 N. Michigan Ave., Chicago 11, Ill.

Section on Radiology, American Medical Association.—Secretary, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

ARKANSAS

Arkansas Radiological Society.—Secretary, J. S. Wilson, M.D., Monticello. Meets every three months and annually at meeting of State Medical Society.

CALIFORNIA

California Medical Association, Section on Radiology.—Secretary, Earl R. Miller, M.D., University of California Hospital, San Francisco, Calif.

Los Angeles County Medical Association, Radiological Section.—Secretary, Roy W. Johnson, M.D., 1407 South Hope St., Los Angeles. Meets second Wednesday of each month at County Society Building.

Pacific Roentgen Society.—Secretary, L. Henry Garland, M.D., 450 Sutter St., San Francisco. Meets annually during meeting of California Medical Association.

San Diego Roentgen Society.—Secretary, Henry L. Jaffe, M.D., Naval Hospital, Balboa Park, Calif. Meets first Wednesday of each month.

San Francisco Radiological Society.—Secretary, Martha Mottram, M.D., Suite 1789, 450 Sutter St., San Francisco. Meets monthly on third Thursday at 7:45 P.M., in Toland Hall, University of California Hospital, from January to June; at Lane Hall, Stanford University Hospital, July to December.

COLORADO

Denver Radiological Club.—Secretary, A. Page Jackson, Jr., M.D., 304 Republic Bldg., Denver 2. Meetings third Friday of each month at the Denver Athletic Club.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Secretary, Max Climan, M.D., 242 Trumbull St., Hartford 3. Meetings bimonthly, second Thursday.

FLORIDA

Florida Radiological Society.—Secretary-Treasurer, Charles M. Gray, 306 Citizens Bldg., Tampa 2.

GEORGIA

Georgia Radiological Society.—Secretary-Treasurer, James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta 3. Meetings twice annually, in November and at the annual meeting of State Medical Association.

ILLINOIS

Chicago Roentgen Society.—Secretary, Warren W. Furey, M.D., 7144 Jeffery Ave., Chicago 49. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April.

Illinois Radiological Society.—Secretary-Treasurer, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—Secretary, Fay H. Squire, M.D., 1753 W. Congress St., Chicago 12.

INDIANA

The Indiana Roentgen Society.—Secretary-Treasurer, Harold C. Ochsner, M.D., Methodist Hospital, Indianapolis 7. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

KENTUCKY

Kentucky Radiological Society.—Secretary-Treasurer, Sydney E. Johnson, M.D., Louisville City Hospital, Louisville. Meeting annually in Louisville, third Saturday afternoon in April.

LOUISIANA

Louisiana Radiological Society.—Secretary-Treasurer, Johnson R. Anderson, M.D., North Louisiana Sanitarium, Shreveport. Meets annually at same time as State Medical Society.

Shreveport Radiological Club.—Secretary-Treasurer, R. W. Cooper, 940 Margaret Place. Meetings monthly on the second Wednesday, at the offices of the various members.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Secretary, Walter L. Kilby, M.D., 101 W. Read St., Baltimore 1. Meets third Tuesday of each month.

MICHIGAN

Detroit X-ray and Radium Society.—Secretary-Treasurer, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave., Detroit.

Michigan Association of Roentgenologists.—Secretary-Treasurer, E. M. Shebesta, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—Secretary, A. J. Stenstrom, M.D., Minneapolis General Hospital, Minneapolis 26. Meetings quarterly.

MISSOURI

Radiological Society of Greater Kansas City.—Secretary, Arthur B. Smith, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—Secretary, E. W. Spinzig, M.D., 2646 Potomac St. Meets on fourth Wednesday of each month except June, July, August, and September, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—Secretary, F. L. Simonds, M.D., 1216 Medical Arts Bldg., Omaha 2. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

NEW ENGLAND

New England Roentgen Ray Society (Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island).—*Secretary-Treasurer,* George Levene, M.D., Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

NEW JERSEY

Radiological Society of New Jersey.—Secretary, H. J. Perlberg, M.D., Trust Co. of New Jersey Bldg., Jersey City. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called by president.

NEW YORK

Associated Radiologists of New York, Inc.,—Secretary, William J. Francis, M.D., 210 Fifth Ave., New York City. Regular meetings the first Monday evening of the month in March, May, October, and December.

Brooklyn Roentgen Ray Society.—Secretary-Treasurer, Leo Harrington, M.D., 880 Ocean Ave., Brooklyn 26. Meets fourth Tuesday of every month, October to April.

Buffalo Radiological Society.—Secretary-Treasurer, Joseph S. Gianfranceschi, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month. October to May, inclusive.

Central New York Roentgen Ray Society.—Secretary-Treasurer, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse 10. Meetings are held in January, May, and October, as called by Executive Committee.

Long Island Radiological Society.—Secretary, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—Secretary, Ramsay Spillman, M.D., 115 E. 61st St., New York 21, N. Y.

Rochester Roentgen-ray Society.—Secretary, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meetings at convenience of committee.

NORTH CAROLINA

Radiological Society of North Carolina.—Secretary-Treasurer, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meeting with State meeting in May, and meeting in October.

NORTH DAKOTA

North Dakota Radiological Society.—Secretary, L. A. Nash, M.D., St. John's Hospital, Fargo. Meetings by announcement.

OHIO

Ohio Radiological Society.—Secretary, Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting will be held at the time and place of the annual meeting of the Ohio State Medical Association.

Cleveland Radiological Society.—Secretary-Treasurer, Don D. Brannan, M.D., 11311 Shaker Blvd., Cleveland 4. Meetings at 6:30 P.M. on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*Secretary-Treasurer,* Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—Secretary-Treasurer, L. E. Wurster, M.D., 416 Pine St., Williamsport 8. The Society meets annually.

The Philadelphia Roentgen Ray Society.—Secretary, Robert P. Barden, M.D., 3400 Spruce St., Philadelphia 4. Meetings held first Thursday of each month at 8:15 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St., Philadelphia.

The Pittsburgh Roentgen Society.—Secretary-Treasurer, Lester M. J. Freedman, M.D., 4800 Friendship Ave., Pittsburgh 24, Pa. Meetings are held on the second Wednesday of each month at 4:30 P.M., from October to June, at the Pittsburgh Academy of Medicine, 322 N. Craig St.

ROCKY MOUNTAIN STATES

Rocky Mountain Radiological Society (North Dakota, South Dakota, Nebraska, Kansas, Texas, Wyoming, Montana, Colorado, Idaho, Utah, New Mexico).—*Secretary,* A. M. Popma, M.D., 220 North First St. Boise, Idaho.

SOUTH CAROLINA

South Carolina X-ray Society.—Secretary-Treasurer, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16. Meeting in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee Radiological Society.—Secretary-Treasurer, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—Secretary-Treasurer, Herman Klapproth M.D., Sherman.

VIRGINIA

Virginia Radiological Society.—Secretary, E. Latané Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

WASHINGTON

Washington State Radiological Society.—Secretary-Treasurer, Thomas Carlile, M.D., 1115 Terry Ave., Seattle. Meetings fourth Monday of each month, October through May, at College Club, Seattle.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary-Treasurer, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russell F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison 6, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

CANADA

La Société Canadienne-Française d'Electrologie et de Radiologie Médicales.—General Secretary, Origène Dufresne, M.D., Institut du Radium, Montreal. Meetings are held the third Saturday of each month, generally at the Radium Institute, 4120 East Ontario Street, Montreal; sometimes, at homes of members.

CUBA

Sociedad de Radiología y Fisioterapia de Cuba.—Offices in Hospital Mercedes, Havana. Meetings are held monthly.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Proper and Improper Administration of Oily Nasal Sprays. Bruno L. Griesman. Arch. Otolaryng. **39:** 124–136, February 1944.

Thirty-one patients between 6 1/2 and 66 years of age, with no history or evidence of upper respiratory infection, were studied roentgenographically to determine the mechanism of the transmission of intranasally sprayed oils from the upper to the lower respiratory tract. With the patient seated in a chair, a "flat" roentgenogram was made with the head in the desired position before the oil was administered, since calcifications of the laryngeal cartilages might interfere with the shadows cast by the oil mixtures and thus confuse the interpretation of the subsequent films. In some cases a 1 per cent solution of an ephedrine salt was first sprayed into the nostrils to shrink the tissues and permit freer distribution of oil. After the oil was sprayed into the nose, exposures were made at certain intervals—from a few seconds to several minutes after instillation—with the tube, the head, and the plate in exactly the same position, in order that the distribution and the gravitation of the oil might be seen.

This study showed that healthy persons, irrespective of age, may aspirate oil even in therapeutic dosage if the oil is improperly administered. The presence or the absence of tonsils and adenoids and the use of a 1 per cent solution of an ephedrine salt prior to the administration of oil apparently do not increase the danger of oil aspiration. Scarring in the tonsillar beds and injury to the posterior pillars after tonsillectomy tend to increase the danger of oil aspiration if the oil is incorrectly administered. Oil is carried downward by the force of gravity. The decisive factor of safety is the position in which the head is held during and after the administration of oil. The danger begins and increases with the size of the angle of the backward inclination of the head. There is no danger when the head is held straight or bent forward, even when massive doses many times the normal therapeutic dose are employed. The factor of safety increases with the size of the angle of the forward inclination of the head.

An Enquiry into the Causation and Characteristics of Cephalhæmatomata. J. Blair Hartley and C. W. F. Burnett. Brit. J. Radiol. **17:** 33–41, February 1944.

Three types of cephalhematoma may be recognized, external, internal, and subaponeurotic. This study concerns only the first. The condition is rare, appearing, according to Sjövall (Acta obst. et gynec. Scandinav. **15:** 443, 1936), in about 0.41 per cent of births. According to this same writer, the right parietal bone is involved in 48 per cent of the cases, the left in 36 per cent, both parietals in 11, and the occipital in 1 per cent. The condition is more common in first-born children, but there is no consistent relation to difficult labors.

Radiological studies of cephalhematomata are few. The authors present 5 cases, in all of which radiographs of the skull were made. Their observations confirm those of others regarding the non-overlapping of the bone margins by the effusion and the occurrence of calcification first and in maximal degree at the summit of the effusion and subsequently from the bony and peripheral aspects, leaving the center of the swelling unossified; later, when ossification finally occurs in large cephalhematomata, the final picture resembles the inner- and outer-table effect of the adult skull.

As to the etiologic factors suggested by their study, the authors say: "We venture to suggest that trauma of a dragging nature is the precipitating factor in causation, but that defective development of the vault bones and hypoprothrombinæmia may also play a part; the hæmorrhages may be small and recurrent, and may occur before labour, during labour at the level of the inlet and also the outlet, or in certain instances at both, or be delayed until after labour." In view of the possible role of hypoprothrombinemia, the authors recommend that treatment include a single dose of 10 mg. vitamin K analogue (2-methyl-1: 4 naphthoquinone) immediately upon the discovery of the lesion, since such a dose is known to be effective in preventing any appreciable fall in the prothrombin concentration of the infant.

SYDNEY J. HAWLEY, M.D.

Normal Air Encephalograms in Patients with Convulsive Seizures and Tumor of the Brain. H. Houston Merritt and Charles Brenner. New England J. Med. **230:** 224–225, Feb. 24, 1944.

The development of convulsive seizures in adults is considered to be due to irritation of the cerebral cortex. In seeking the cause of this irritation a ventriculogram or encephalogram is made to determine the appearance of the ventricles. Should the ventricular system be normal, the possibility of a neoplasm is believed to be excluded. The authors, however, present the complete case histories of 3 patients in whom normal appearing ventricular systems were demonstrated seven, twenty, and thirty months, respectively, after the initial convulsive seizure but in whom brain tumors were subsequently proved. The conclusion is that a negative report of an encephalogram should not be considered as definitely excluding the possibility of a neoplasm.

JOHN B. MCANENY, M.D.

Rupture of a Left Temporo-Sphenoidal Brain Abscess into the Ventricle: Report of a Case, with Recovery. Louis E. Wolfson. New England J. Med. **230:** 170–171, Feb. 10, 1944.

A 56-year-old blind man, who had a chronic left mastoiditis from the age of 5 years, contracted an upper respiratory infection with exacerbation of the mastoiditis and development of left facial paralysis. The left mastoid was opened and drained, with improvement. Five days postoperatively there was a rise of temperature and the patient became drowsy, with loss of motion in the right arm and leg. The operative site was reopened and the dura and brain were incised. A cannula was inserted for a distance of 3 cm. and pus was obtained. The drain was left in place. Half an hour after drainage, the paralysis began to clear.

In an effort to determine the extent and character of the infected area, lipiodol was instilled, defining the drainage area, which was found to extend into the left lateral cerebral ventricle.

The patient recovered and returned to work. Reexamination showed the lipiodol in the ventricular system.

JOHN B. MCANENY, M.D.

THE CHEST

Control, Duplication and Standardization of Radiographic Chest Technique. Wm. H. Weidman and Jean Kieffer. Am. Rev. Tuberc. **49:** 203–226, March 1944.

In comparing serial chest films, particularly in the study of tuberculous lesions, it is essential that the technical quality be as nearly comparable as possible. A method is described whereby a duplication of chest technic is possible within a limit of plus or minus 2 kv.p. from expected results, in approximately 93 per cent of a large series of films. For this purpose a step tablet is used consisting of six steps made of copper foil 0.107 mm. thick. The steps measure 6 × 6 mm. each and are composed of 2, 3, 4, 5, 6, and 7 layers of foil, respectively. They are surrounded by a lead mask. The use of copper makes the step tablet thin enough so that it can be placed directly on the cassette without interfering with the movement of the cassette changer. At the radiographic range of 45 to 90 kv.p. these steps have approximately the same absorption as steps composed of a similar number of layers of 1/8 inch aluminum.

Any variation in tablet densities produced on different radiographs by a supposedly similar technic indicates variation in that technic, and proper analysis may often reveal the cause of the variations and indicate the necessary correction. Also, in serial studies of chest disease the correlation between the tablet images on two films taken at different times affords an accurate indication of the relation between the total technics used on the two occasions.

In addition, a set of standards was prepared consisting of tablet images taken at 2 kv.p. intervals and covering the entire range of technic routinely used. These were developed with extreme care, with standard darkroom procedure and exact control of temperature, development time, and agitation. By this means a standard was obtained consisting of tablet images of various densities, with each image representing the result expected from the standard technic. Routine comparison of films taken subsequently against this standard shows immediately whether or not the result of the technic used for each finished film was exactly as expected and, if not, how great was the departure from expected results. When such a technic is employed, at least 80 per cent of all films fall within limits of plus or minus 2 kv. Should less than 70 per cent of them fall within these limits, the cause of the discrepancy should be investigated. When the films match a tablet image standard within narrow limits as to contrast but show marked variation in density, variations in exposure are indicated. The most common cause is an inaccurate timer; next, the use of cassettes of different speeds, and finally rapid fluctuations in line voltage occurring between the setting of the machine and the actual exposure. When the films show marked differences in contrast as well as density, variations in processing are indicated. In the average laboratory such variations in the processing procedure are by far the most common cause of lack of duplication.

L. W. PAUL, M.D.

Discussion of the Organization of a Fluorographic Service for the Civilian Community. Maurice Davidson, Peter Kerley, *et al.* Proc. Roy. Soc. Med. **37:** 185–192, March 1944.

The problems expected to arise in organization of a mass fluorographic service for civilians were discussed before the Section of Radiology of the British Royal Society of Medicine.

Dr. Maurice Davidson stated that the practical difficulties of mass radiography by standard methods can be surmounted by the use of miniature films, which can then be projected on a screen and enlarged to permit recognition of abnormal shadows. He emphasized that the diagnosis is not to be made from these films, but those found suspect are to be referred for complete examination by standard methods. Because of the fatigue element, a definite limit should be set as to the number of films examined at one sitting.

Doctor Davidson's primary interest is in the importance of this work to social medicine, and he advocates the universal adoption of mass radiography as a necessary contribution to preventive medicine, particularly the prevention of tuberculosis. One of the problems in obtaining the adoption of such a service is to get the support and backing of the entire medical profession. Too many clinicians fail to understand that active pulmonary tuberculosis may be entirely symptomless. The problem of medical ethics is raised, since, when the diagnosis of tuberculosis is made, the knowledge is a matter of professional confidence. How it can be made useful without violation of medical ethics, how treatment is to be carried out on patients requiring it, and how patients and their dependents are to be compensated for loss of earnings are other questions incompletely answered. Obtaining the co-operation of the groups to be examined may also be a problem.

Dr. Peter Kerley discussed the equipment, the constitution of the team, and the arrangements for disposal of the pathological cases. The recommended equipment consists of a 400-ma. four-valve unit energizing a rotating anode tube. The camera is automatic with a 1.5 coated lens. Eventually each unit should have its own mobile generator. An experienced team can easily handle 1,500 cases a week.

Dr. P. D'Arcy Hart, who spoke from his experience in factories and offices, pointed out that mass radiography is in general favor among working people, but propaganda is required in individual units. This is best carried out through shop stewards and through individual leaflets in pay packets. Agreement should be obtained from the management as to the confidential nature of the results.

Wing-Commander R. R. Trail called attention to the need for available sanitarium, outpatient, and hospital facilities before the chest surveys are made so that there will be no delay in treatment and so that proper follow-up will be possible.

Dr. L. Banszky was not in agreement with Doctor Hart that explanation to the workers is necessary before radiographic examination of the chest is carried out. In his experience fluoroscopic examination was done as part of the medical examination. When the presence of tuberculosis was established, the patient was sent to a public hospital for confirmation of the diagnosis. If the patient had to leave the factory for sanatorium care, his job was held open for him until his condition permitted his return. No compensation had ever been asked for tuberculosis by the employees.

Dr. W. Allen Daley discussed the cost of equipment and maintenance for a mass-radiography unit. He found that the local electric supply cable was frequently inadequate and a special cable had to be put in. It is estimated that 100 extra sanatorium beds are needed for each mass radiography set in active use.

Dr. Philip Ellman emphasized the importance of close co-operation between technician, chest radiologist, and chest physician. He doubted that anyone could be trained in a few months to take the responsibility of correct interpretation of miniature films. He agreed that any scheme for a fluorographic service for the civilian population should be entirely dissociated from existing tuberculosis clinics.

Dr. Norman P. Henderson called attention to problems arising in connection with co-operation between the factory medical officer, the medical officer in charge of the mass radiographic unit, and the private physician. Thus treatment and follow-up are often difficult to accomplish after the diagnosis of disease has been made. He recommended organization of a series of regional examining boards of well qualified physicians to interpret the films and a central consultative board as a last source of appeal in difficult cases.

H. H. WRIGHT, M.D.

Chest Screening in an Ante-Natal Clinic. Rachel Frank and A. L. Jacobs. Brit. M. J. **1:** 394, March 18, 1944.

The authors give a short but practical commentary on the procedure of chest fluoroscopy of ante-natal patients in a large clinic in England. The examination is rather brief and only 35 to 40 minutes a week are required to cover all incoming cases. Full-sized films are ordered whenever the screen findings are at all suspicious.

From a series of 1,125 cases screened in one year, certain significant figures were obtained. Sixty-three films were used in this series; 22 cases of active tuberculosis and 2 of possible tuberculosis were discovered in addition to various minor conditions of a non-specific type. It is also noted that inspection among the W.A.A.F.'s by miniature radiography disclosed 0.4 per cent requiring treatment and 0.6 per cent in need of observation.

In a final comment the authors state that the best method of mass chest examination is miniature radiography but that, in the absence of facilities, screen examinations are by no means to be despised. Several cases of heart disease were discovered by fluoroscopy.

Q. B. CORAY, M.D.

Demonstration of Pulmonary Lobes and Interlobar Fissures by Roentgenograms of an Artificial Thorax. E. M. Medlar, G. S. Pesquera, W. H. Ordway, and E. C. Lasher. Am. J. Roentgenol. **51:** 267–279, March 1944.

It is often important to determine whether the initial lesions and the "spreads" of pulmonary tuberculosis are in the upper or the lower portions of the lobes of the lungs. The prominent position now held by thoracic surgery also calls for the location of pulmonary lesions in relation to the pulmonary lobes.

The authors obtained a pair of human lungs at necropsy, with complete interlobar fissures on both sides. The lungs were fixed by a process described in the paper. Plaster molds were made of each lung and of each lobe. An artificial thorax was constructed. To demonstrate the position, size, and shape of the interlobar fissures thin sheets of lead foil were placed between the lobes. Pathological processes were simulated in various locations and roentgenograms were taken.

It was found that horizontal planes through the chest at the level of the fourth and sixth costovertebral junctions have a practical value when interpretations in relation to pulmonary lobes are under consideration. The practical value of interpretations of chest roentgenograms will be enhanced provided the following suggestions in relation to the two planes mentioned are used:

1. Pathologic processes above a horizontal plane at the level of the fourth costovertebral junction will be in the upper portions of the upper lobes. In tuberculosis the majority of lesions will be dorsal in position.

2. Below a horizontal plane at the level of the sixth costovertebral junction pathologic processes in the dorsal half of the chest will be in the lower lobes, especially if the main lesion abuts the dorsal surface of the chest cavity. Pathologic processes in the ventral half will be in the upper lobe on the left and in the middle lobe on the right.

3. The area between horizontal planes at the fourth and sixth costovertebral junctions represents the common variations of the upper edge of the main fissures on either side. If in this area the pathologic condition is present in the ventral two-thirds of the chest, the upper lobes are surely involved. If, however, the lesion adjoins the dorsal surface, involvement of the apex of the lower lobe must be seriously considered.

CLARENCE E. WEAVER, M.D.

Determination and Treatment of Pressure Cavities in Pulmonary Tuberculosis. Arthur M. Vineberg and Walter E. Kunstler. Surg., Gynec. & Obst. **78:** 245–274, March 1944.

During a revision thoracoplasty for a residual cavity the authors needled the cavity and took manometric readings. To their surprise the intracavity pressure was high and from its fluctuations during respiration it was evident that the bronchus entering this residual cavity was partially blocked, the obstruction being of the check-valve type. It followed logically that they would suppose that the failure of the original thoracoplasty was due to the increased pressure within the cavity. This prompted a study of pressure cavities, and the present paper is the result of the authors' experience and an explanation of the instruments and technic they developed in 150 diagnostic cavity needlings and 27 therapeutic cavity drainages.

The historical background of pulmonary cavity formation is detailed and the physiological and mechanical factors in the growth of various types of cavities are explained and illustrated. The classification of Coryllos is followed: (1) the cavity with the open bronchus, permitting growth of tubercle bacilli and a positive sputum; (2) the closed cavity with negative sputum; usually shrinking in size as its air is reabsorbed; (3) the cavity with the check-valve type of obstruction causing increased intracavity pressure and concomitant ballooning out of the cavity.

Like Coryllos, the authors believe that the complete obliteration of the draining bronchus is essential in obtaining permanent closure of a cavity. They do not feel that films aid in the diagnosis of these cavities as pressure cavities. Nor can the thickness of the wall be determined, as in this type of cavity a portion of the seemingly thick wall is made up of adjacent atelectatic lung tissue.

When it becomes necessary to consider thoracoplasty to obliterate a tuberculous cavity in the lung, intracav-

ity pressure readings should be obtained. If these indicate the presence of a tension cavity, thoracoplasty as an initial measure should not be undertaken, but preliminary suction drainage should be done. The authors are emphatic, however, that suction drainage is not enough. Permanent closure necessitates thoracoplasty following drainage. In giant tension cavities where the parietal pleura has been reached, a preliminary relaxing anterior thoracoplasty precedes the cavity drainage. By these preliminary measures, the size of the cavity is reduced with salvage of normal lung tissue and therefore a greater final vital capacity for the patient. The cavity is rendered negative for tubercle bacilli, the draining bronchus is closed, and a less radical thoracoplasty is required.

The technic and instruments used for transthoracic needling and subsequent introduction of the catheter for drainage are fully described and generously illustrated. The safety of the method is stressed. In 150 cavity needlings and 27 cavity drainages there was not one instance of empyema, pneumothorax, hemorrhage, or air embolism.

J. FRANCIS MAHONEY, M.D.

Quantity of Focal (Tubercle) Calcium in Human Lungs. Paul E. Steiner, D. Warren Stanger, Miriam Bolyard, and A. W. Marcovich. Am. Rev. Tuberc. **49:** 129–139, February 1944.

A method is presented for the quantitative determination of focal calcification in the lungs and other tissues, together with the results of its use in 119 pairs of human lungs. The method consisted in the preservation of the lungs removed at autopsy in alcohol, the volume of alcohol in cubic centimeters being equal to the weight of the lungs in grams. To this was added a 10 per cent aqueous potassium hydroxide solution equal in volume to that of the alcohol. Saponification was carried out by heating for twenty-four hours on a steam bath. The concretions fall to the bottom of the flask and can be removed by decantation. After removal they were washed several times with water, air dried, and weighed.

Focal calcium was found in 88.8 per cent of the lungs examined, the average amount being 0.231 gm. The quantity and the incidence of positive cases increased sharply between the thirtieth and fifty-ninth years, but not thereafter. No important differences were detected in the quantity of calcium found in the two sexes or in rural and urban dwellers. The deposits were usually multiple.

In 50 cases a comparison of the reliability of this chemical method with roentgenograms in detecting calcified foci was made. In 78 per cent there was agreement, while in 11 cases, or 22 per cent, calcified foci were discovered chemically which the roentgenograms did not reveal. The causes of failure were chiefly concomitant disease in the chest and a small amount of focal calcium located outside of the lung fields. With roentgenograms it was possible to detect small calcified foci containing as little as 9 mg. of calcium when located in the lung field.

L. W. PAUL, M.D.

Intrabronchial Spread Following Thoracoplasty. Mandel Weinstein and Steven Tyau. Am. Rev. Tuberc. **49:** 238–250, March 1944.

The importance of intrabronchial spread of tuberculosis following thoracoplasty is emphasized by a study of the 198 thoracoplasty operations performed during 1942 at the Sea View Hospital. A total of 19 instances occurred, in 14 patients, giving an operative incidence of approximately 10 per cent. Four deaths were directly caused by the tuberculous spread, a mortality of 2 per cent. In 12 of the 19 cases the spread occurred after the first stage of thoracoplasty; in 6 it followed a second-stage thoracoplasty; and in only 1 did it develop after a third-stage operation. Age and sex had no bearing on the incidence or severity of the spread. The complication occurred more frequently in Negroes than in whites and all 4 patients whose deaths were directly contributed to by the spread were Negroes.

In 2 patients spread occurred in the contralateral lung in spite of the presence of therapeutic pneumothorax on that side. In 5 cases a spread occurred in the homolateral lung; in 10 to the contralateral lung; and in 4 the spread was bilateral. The middle and lower lung regions were the most frequent sites of involvement.

No single precaution or procedure known at the present time can eliminate this complication of thoracoplasty. The incidence and severity can be lessened, however, by proper selection of cases and by careful preoperative preparation. Preceding the operation, the patient should empty the bronchial tree well of all secretion, by cough and postural drainage. Patients should be anesthetized so that they react immediately following the procedure. Narcotics and sedatives should be used sparingly and infrequently. Those patients with extensive disease and much cavitary exudate are more prone to spread after thoracoplasty.

L. W. PAUL, M.D.

Silico-Tuberculosis. Oscar Auerbach and Marguerite G. Stemmerman. Am. Rev. Tuberc. **49:** 115–128, February 1944.

In order to determine whether or not pneumoconiosis alters or is itself altered by pulmonary tuberculosis, the authors reviewed the autopsy and clinical findings in 54 cases of silico-tuberculosis and compared them with 9 cases of pneumoconiosis without tuberculosis and 200 cases of tuberculosis without pneumoconiosis. The results of the study are in some disagreement with the reported findings of others. Thus, clinically, the course of the disease, when silicosis and tuberculosis coexisted, was not appreciably different than when only tuberculosis was present. Also, the pathologic material showed little or no alteration in the appearance of the pulmonary tuberculosis when it was associated with silicosis. In all of the cases studied, the silicosis and tuberculosis could always be distinguished as two separate and independent processes. There was no evidence that the silicotic foci resulted from the inhalation of dust combined with tubercle bacilli. Nor was there any indication that the massive fibrosis in silicosis is usually the result of a tuberculous infection. There was no evidence of tubercles on microscopic examination within these areas of massive fibrosis, even though large areas of tissue were examined. However, tuberculous foci bordering the fibrosis were not unusual. Tuberculosis is altered by pneumoconiosis only in so far as the silicotic nodules prevent the full development of tuberculous granulation tissue and, in the walls of cavities, the pyogenic membrane. The size, situation, and number of cavities are approximately the same. There is a slightly greater incidence of perforation of the

cavities through the interlobar fissures in the silicotics and a greater incidence of death from fatal pulmonary hemorrhage. Most patients died of progressive pulmonary insufficiency. L. W. PAUL, M.D.

A Plea for the Prevention of Bronchiectasis. Karl Kornblum. Am. J. Roentgenol. **51:** 292–314, March 1944.

This is a general discussion of bronchiectasis with emphasis on etiology and prevention. It should be read in the original. "In general," the author says, "two of the most useful and important procedures in the prevention of bronchiectasis are the roentgen examination of the chest and bronchoscopic examination. In every affection of the respiratory tract in which symptoms are persistent or do not readily respond to treatment, a roentgen examination is indicated, including the sinuses as well as the chest. This will frequently reveal conditions which, if promptly taken care of, will prevent the development of bronchiectasis. . . .

"Finally, in the prevention of bronchiectasis an educational program for both the laity and the medical profession is of prime importance . . . .

"In this educational program the roentgenologist has an excellent opportunity to render real service . . . . he has an opportunity to view the entire life history of bronchiectasis from the etiological stage to the terminal events. He can educate his colleagues regarding many of the pertinent facts of bronchiectasis, he can direct their attention to the possibility of a developing or the existence of an early bronchiectasis, and finally he can suggest a bronchoscopic examination when in his opinion this procedure is indicated. Thus, in the prevention of bronchiectasis, a roentgenologist who is conscious of and has a full knowledge of this disease is an asset of prime importance."

Pseudobronchiectasis. Brian Blades and David J. Dugan. J. Thoracic Surg. **13:** 40–48, February 1944.

The authors have seen 6 cases in which a chronic productive cough persisted following so-called "atypical" or virus pneumonia and lipiodol filling of the bronchi showed a cylindrical type of bronchiectasis. The first patient encountered was transferred to the surgical service for lobectomy, but since the history was atypical, having started with the acute pneumonia a short time before, the operation was postponed. Two months later a bronchogram showed disappearance of the bronchiectasis and the symptoms had ceased. In the other 5 cases the history and roentgen findings were similar.

The exact method of development of the bronchiectasis is not understood at this time. It is important to remember, however, that temporary dilatation of the bronchi can occur following "atypical" pneumonia and may persist for as long as three months.

HAROLD O. PETERSON, M.D.

Primary Atypical Pneumonia (Virus Pneumonia). Robert C. Schmitz. Wisconsin M. J. **43:** 228–233, February 1944.

A review of the signs, symptoms, and treatment of primary atypical or virus pneumonia is presented in concise and condensed form. A chart setting forth the features differentiating between this condition and lobar pneumonia, influenza, and bronchopneumonia is also included.

The roentgen findings, as has been repeatedly pointed out, are usually out of proportion to the physical findings. "The roentgen plate will become positive by the second and third days of the disease. It may simulate the picture of bronchitis and bronchopneumonia. The interstitial spread of the disease produces cottony shadows in the parenchyma. These smaller areas may coalesce to simulate lobar pneumonia except for the fact that the vascular and osseous markings are not obscured. There may be just a diffuse increase in density in one or more lobes, a wedge-shaped area of infiltration at one or both costophrenic angles, at the cardiohepatic angle, or in either or both of the hilar areas. The lower lobes are involved most frequently. During resolution, the plate may simulate that of tuberculosis."

Treatment is essentially symptomatic, the sulfonamide preparations having no specific effect. Transfusions of convalescent donors' blood are believed to be of definite value.

Two rather unusual case histories are given. Case 1 is that of a two-year-old girl admitted in a toxic state with cerebral symptoms, with bubbling râles over the entire chest but with a normal appearing chest roentgenogram. She died three hours after admission and autopsy revealed patches of consolidation in both bases. In Case 2 roentgen examination showed infiltration in only the right lung, although moist râles were present bilaterally. LESTER M. J. FREEDMAN, M.D.

Roentgenographic Manifestations of Atypical Pneumonia of Unknown Etiology. W. E. Crysler. Am. J. Roentgenol. **51:** 280–291, March 1944.

This report is based on 178 cases of bronchopneumonia, demonstrated by roentgenographic examination, in personnel of the Royal Canadian Navy. Bacteriological studies, when done, revealed no positive pathogens. As a routine, postero-anterior and the appropriate lateral roentgenograms of the chest were obtained.

There was no notable relationship between the anatomical extent of the disease as shown in the roentgenograms and the severity of the symptoms. Pneumonic infiltrations were discovered in the enlistment roentgenograms of 12 recruits who had no complaints other than a recent "chest cold." A lag of two to three days was occasionally noted between the clinical and roentgen evidence of pneumonia. Eighty per cent of the lesions were confined to the lower lobes.

In almost all cases the parenchymal infiltration manifests itself by a peribronchial distribution. The lateral view often reveals a confluent bronchopneumonia radiating fanwise from the hilum. Early infiltration commences in one of two ways: First, an ill-defined blurred, localized structural accentuation occurs. The peribronchial blurring may extend and coalesce, producing a frank parenchymal infiltration. Accentuated structural markings are usually visible through this shadow. In the second method of development an area of localized accentuation is followed by the appearance of flocculent densities, peribronchial in distribution. Occasionally both homogeneous and flocculent densities are demonstrable in the same lesion. When regression of the infiltration is complete, the structural accentuation often recedes more slowly, being last to disappear.

Certain lesions, when confined to the upper lung

field, resemble pulmonary tuberculosis. Pleuritis with effusion is a rare finding. Lateral roentgenograms are helpful and important in localizing the process. In 21.3 per cent of the cases elevation of a hemidiaphragm was noted and was interpreted as evidence of atelectasis. With atelectasis, resolution is delayed. Resolution is the rule. Accompanying atelectasis probably accounts for the rare development of bronchiectasis. Non-resolution with clinical evidence of asthma has also been observed. The clinical diagnosis at present should be "atypical pneumonia, etiology unknown." CLARENCE E. WEAVER, M.D.

Acute Diffuse Interstitial Fibrosis of the Lungs. Louis Hamman and Arnold R. Rich. Bull. Johns Hopkins Hosp. **74:** 177–212, March 1944.

Since 1931, 4 cases of pulmonary disease presenting a picture unfamiliar to physicians and pathologists have been observed at Johns Hopkins Hospital. The symptoms of each case differed somewhat from those of the others and yet bore a striking resemblance. The pathological process in the lungs was identical in all, and this lesion was so extraordinary and distinctive that there can be no doubt that the symptoms displayed by each case, different though they were, arose from the same underlying morbid process, their variation depending upon the stage this process had reached at the time of observation. This clinical and pathological entity is characterized by a peculiar, progressive, diffuse fibrosis of the pulmonary alveolar walls, leading to deficient aeration of the blood, with resulting dyspnea and cyanosis, and to enlargement and eventual failure of the right side of the heart. The etiology of the condition is at present undetermined.

Idiopathic Spontaneous Pneumothorax. S. H. Babington. West. J. Surg. **52:** 73–76, February 1944.

A statistical study is presented of 44 cases of so-called idiopathic spontaneous pneumothorax; 31 were found in recent medical literature and 13 new cases are added. Collection of data was difficult because of incompleteness of many of the case histories. [Actually not all the cases in the combined series were entirely spontaneous, and in some the associated lesions were such as to make the use of the term "idiopathic" questionable.—L. M. J. F.]

Fifty-two per cent of the cases occurred in the third decade; 86.5 per cent were in males. The great majority gave no history of occupational strain. The left lung was affected in 24 instances, the right in 18. The history was negative for chest accidents or afflictions in 65 per cent, but this figure includes 11 cases in which no statement on that point was obtainable. Eleven (25 per cent) patients had symptoms ranging from a few days to two months preceding the attack.

Pain was absent in 8 cases; it occurred in the remaining 36 in varying degree. Cough was mentioned in only 3 cases. Five patients had primarily abdominal symptoms, in 1 case leading to a diagnosis of perforated peptic ulcer. The most common symptom after pain was dyspnea, which occurred in 26 patients. Many of the patients were quiet at the time of the attack, while others were under moderate strain.

On physical examination, 3 patients were in shock, 3 showed cyanosis, and 4 had fever. Sixteen had an increased white blood cell count—from 10,000 to 36,900—with a relative polynucleosis in 8.

The x-ray findings may be enumerated as follows: adhesions in 8 patients; pulmonary bullae in 5; pneumonic process in 1; fluid (one bloody) in 10; mediastinal displacement in 12; complete lung collapse in 2.

Treatment consisted for the most part in rest and sedation. Several patients required thoracoscopy to sever adhesions, aspiration of air and fluid, and transfusion. Twenty-three per cent had repeated attacks. One patient was brought in dead. All of the rest eventually recovered. LESTER M. J. FREEDMAN, M.D.

An Occupational Disease of Electric Welders. T. R. Jones and Jessie A. Lockhart. Texas State J. Med. **39:** 532–534, February 1944.

Electric welding is ordinarily done with rods composed of approximately the same alloy as the material being welded, with a covering containing silicon and asbestos, the purpose of which is to furnish a protective screen of gases about the welding surface. The fumes produced during the process contain ozone, nitrogen oxides, silicon, asbestos, iron, and metallic oxides characteristic of the alloy being welded.

Experimental animals forced to breathe concentrated welding fumes with the iron particles filtered out die of pulmonary edema. Ozone and nitrogen oxides are recognized as the basic cause, with the nitrogen oxides probably being the chief offenders. In man welding fumes may produce acute or chronic pulmonary changes.

The acute changes produced by heavy concentrated exposure consist of pulmonary edema complicated by bronchial ulceration and pneumonia. With continued exposure this progresses to an acute bronchitis characterized by severe cough, profuse expectoration of blood-tinged sputum, fever, loss of weight, malaise, and inability to work.

Chronic changes, developing after repeated exposure, consist of chronic bronchitis, pulmonary fibrosis, asthmatic wheezing, and eventually pulmonary emphysema.

With adequate ventilation, men may work as electric welders for periods of ten to twenty-five years and remain in good health. In many such workers, however, x-ray examination reveals a fine mottling scattered throughout both lung fields, shown at autopsy to be due to deposits of iron particles less than 0.5 micron in diameter.

The authors briefly report 6 cases of acute pulmonary conditions following heavy exposure to electric welding fumes in poorly ventilated, confined spaces. Three of the patients had pulmonary edema; 1 of these, along with the pulmonary changes, had a "metal fume fever" due to zinc oxide from welding galvanized iron pipe. The remaining 3 patients were men with apparently healed tuberculosis. In these, moderate to severe pulmonary hemorrhages followed six, eight, and ten weeks' exposure, respectively, but no subsequent spread of the tuberculosis was demonstrated. All cases improved promptly following cessation of exposure, which is the only effective treatment.

E. W. GODFREY, M.D.

Further Observations on Lung Changes in Electric Arc Welders. O. A. Sander. J. Indust. Hyg. & Toxicol. **26:** 79–85, March 1944.

It has become quite generally recognized that both acute and chronic lung changes may occur when welders

are exposed to highly concentrated fumes. It is the chronic changes which are considered here. As seen on chest roentgenograms, these consist of discrete nodular shadows uniformly distributed throughout both lungs, resembling somewhat the appearance of classical silicosis. The borders of these round shadows are generally more sharply defined, however, than are silicotic nodules, and the hilum shadows are less prominent. Histologic sections from a case coming to autopsy showed deposits of iron pigment in the lymphatics surrounding the blood vessels. The iron appeared to excite no reaction and evidence of fibrous tissue proliferation was entirely lacking. It has been concluded that these iron collections are responsible for the nodule-like shadows seen on x-ray films.

The finding of nodular shadows on chest roentgenograms of electric welders has been frequently reported since the author's previous communication (Enzer and Sander: J. Indust. Hyg. & Toxicol. **20:** 333, 1938). Among 256 welders, Britton and Walsh found 24 with pseudo-nodulation (J. Indust. Hyg. & Toxicol. **22:**125, 1940). The author reviewed 500 welders' films and found an incidence of nodular shadows of less than 5 per cent. This was at first attributed to the fact that very few industries in the district from which these films were obtained required *confined* welding. Recently, however, pulmonary changes have been discovered in welders whose work was not at all confined except for canvas partitions between groups of workers. In this group, 54 of the first 80 welders examined roentgenographically showed definite small nodular shadows. This could be explained only on the basis of excessive fume production and improperly placed ventilation.

Five cases are reported and roentgenograms for each are reproduced.

The following conclusions are drawn: (1) Electric arc welding which is done in large rooms and where the fumes are not allowed to concentrate excessively near the breathing level does not cause any lung changes even after many years of work. (2) Excessive inhalation of concentrated fumes, especially in confined and unventilated spaces, may cause siderosis in the lungs in from six to ten years. The siderosis so produced consists only of inert iron pigment deposits in the lymphatics, without fibrous tissue proliferation and without progressive changes after exposure is materially decreased. (3) Electric welding and siderosis do not predispose to tuberculosis or other lung infections. (4) Siderosis of welding causes no functional impairment of the lungs and, therefore, no symptoms referable to the lungs. (5) Acute irritative phenomena of the throat may occur with too prolonged confined work in dense clouds of fumes, but these appear to be transitory reactions leaving no residual impairment. (6) Respiratory involvement may be prevented in welding, even with the most confined and prolonged work, if proper precautions are taken, either by adequate exhaust ventilation, ventilated helmets, or positive pressure respirators.

The authors prefer to designate these cases as "siderosis of welding," but this does not imply the presence of fibrous tissue proliferation.

Miliary Densities Associated with Mitral Stenosis. Allan Hurst, Sydney Bassin, and Ida Levine. Am. Rev. Tuberc. **49:** 276–285, March 1944.

Disseminated miliary densities in the lungs may occur in association with rheumatic mitral heart disease and are readily confused with other miliary processes, such as tuberculosis, sarcoid, pneumoconiosis, and lymphangitic carcinomatosis. Five cases observed by the authors are reported, with illustrative roentgenograms.

The cause of these miliary or submiliary densities has been in some dispute. Thus, they have been ascribed to the formation of hemosiderin pigment deposits and surrounding tissue reaction, to engorged blood vessels "caught on end," and to engorged perivascular lymphatics due to pressure on the main lymphatic trunks by the enlarged heart.

In one of the cases described the lungs were studded from apex to base with soft fluffy densities. These were thought to represent engorged blood vessels "caught on end," a condition which is usually transient in character. In the second case there was a marked vascular engorgement throughout the lung fields arranged in a linear pattern, and observation over a period of ten months showed no variation in the roentgenograms. Another case showed a combination of linear and nodular mottling and, in addition, in the periphery of the lower lung field, some larger denser nodules. These were assumed to consist of local areas of perivascular fibrosis with deposition of hemosiderin pigment from the extravasation of blood. The authors believe that in the first two instances the x-ray changes were the result of simple vascular dilatation, either of transient or permanent nature. The other cases, showing larger and firmer nodules and dense linear shadows or bands, are considered to be altogether permanent and appeared to be progressive.

L. W. PAUL, M.D.

Intrathoracic Tumors as a Problem in Diagnosis. Raymond J. Harrington. J. Iowa M. Soc. **34:** 45–59, February 1944.

Accurate diagnosis of intrathoracic tumors is of considerable clinical importance since the advent of improved technic in surgical approach. The mortality rate of pneumonectomy has decreased from 63 per cent to 10 per cent and there are numerous reports of five- to nine-year cures of bronchiogenic carcinoma.

The most frequent intrathoracic tumor is the metastatic lesion. Solitary pulmonary metastases are difficult to differentiate from primary tumors, and their diagnosis must be based on a thorough search for a primary source. Metastases are usually situated in the lower lung fields and are multiple.

In general, the primary intrathoracic tumors may be classified as originating from the mediastinum, lungs, or from certain elements of the chest wall. The most common tumor in the primary group is bronchiogenic carcinoma. Squamous-cell and mixed or small-cell carcinomas comprise 70 to 90 per cent of this group. These tumors occur chiefly near the hilus, since they usually arise from the larger bronchi. They are considered more amenable to treatment than the less common adenocarcinoma because of the possibility of early diagnosis due to encroachment of the tumor on the bronchial lumen with resultant symptoms—early cough, hemoptysis, and dyspnea. Frequent chest roentgenograms and repeated bronchoscopic examinations are essential for an early diagnosis. Adenocarcinoma of the lung usually arises from the smaller bronchi near the periphery. It gives few signs and symptoms early in its course and at this stage is usually found by accident. It tends to invade the pleura, ribs,

or cervical plexus and to metastasize *via* the blood stream, frequently to the brain.

Bronchial adenoma usually occurs in the larger bronchi and has a greater tendency to bleed than carcinoma. The clinical features and roentgen findings are indistinguishable from carcinoma, being those of bronchial obstruction with ensuing emphysema, atelectasis, and infection. Bronchoscopic examination and biopsy ordinarily determine the diagnosis.

The relative position and the character of the roentgen shadow aid in differentiating the numerous, although uncommon, mediastinal tumors. Experience shows that solitary, clearly defined, and circumscribed lesions are usually benign, while the malignant tumors produce diffuse, poorly defined, irregular shadows. This rule is not absolute, however, since a benign lesion may contain areas of malignant change or a well defined shadow may be due to a mediastinal abscess or non-pulsating aneurysm. Localization of mediastinal tumors may be deduced from the symptoms and signs produced by pressure and invasion of neighboring structures. There may be local or referred pain, dyspnea, cyanosis, venous dilatation, cough with or without expectoration, hemoptysis, Horner's syndrome, dysphagia, hoarseness, and paralysis of the diaphragm. Diagnostic pneumothorax, special studies of the sternum and spine, and esophagrams may be necessary in addition to the routine fluoroscopic and roentgen examination of the chest.

Primary tumors of the mediastinum are rare, the most common being the dermoid cyst or teratoid tumor. These lesions usually occur in young adults, are sharply defined, arise in the anterior mediastinum, and may become very large with practically no symptoms. Overpenetrated films may show incompletely formed teeth or bone or other calcification within the shadow. The ganglioneuromas, neurofibromas, and perineural fibroblastomas are rounded lesions situated in the posterior mediastinal gutter and are considered potentially malignant. Those originating from the spinal or sympathetic nerves may be hour-glass in form and involve the spinal canal, producing referred back pain and even paralysis. Cystic tumors may arise from the respiratory epithelium or pericardium. Chondromas and osteochondromas may spring from the costochondral junctions, invading the anterior mediastinum, or from the costovertebral structures, growing into the posterior mediastinum.

Lymphoblastoma involving the mediastinal nodes produces a sharp, lobulated or nodular, bilateral but asymmetrical shadow having equal density with that of the heart. It is most difficult to differentiate the type of lymphoblastoma by x-ray but lymphosarcoma is believed to have a tendency to be unilateral.

A definite clinical diagnosis of thymic tumors is difficult during life, the usual course being less than six months after the onset of symptoms. Lymphosarcoma and thymoma are the most common forms. Tumors of the thymus gland usually occupy the anterior mediastinum and compress the trachea and great vessels.

Substernal tumors of the thyroid gland are rarely completely intrathoracic. They can be recognized by their upward movement on swallowing and by compression or displacement of the trachea and other surrounding structures.

Aortic aneurysm, innominate aneurysm, and right-sided aortic arch are mentioned because of possible confusion with neoplasms. The one constant diagnostic feature is the inability to separate the mass from the vessel shadow by any degree of rotation of the patient. Other variable aids are erosion defects in the sternum or vertebrae, calcifications continuous with those in the aorta, pulsation, esophageal displacement, and serologic evidence of syphilis.

The following tumors can be removed surgically with success: teratomas, dermoid and other cysts, intrathoracic goiters, benign connective-tissue tumors including those arising from cartilage, benign neurogenic tumors, benign thymic growths, and certain primary sarcomas. The primary malignant tumors of the mediastinal lymph nodes and malignant thymomas are best treated by radiation therapy.

Ten case histories are presented accompanied by roentgen illustrations. Three of the 6 cases of bronchiogenic carcinoma revealed fairly well circumscribed pulmonary masses; the remaining 3 showed x-ray evidence of bronchial obstruction and atelectasis. Two cases of mediastinal tumor are included, a lymphosarcoma and benign cyst. One case resembling bronchiogenic carcinoma clinically proved to be a non-specific pneumonitis. The tenth case was a large asymptomatic aneurysm. LESTER M. J. FREEDMAN, M.D.

Huge Intrathoracic Fibroma: Report of a Case. O. Theron Clagett and Paul F. Hausmann. J. Thoracic Surg. **13:** 6–15, February 1944.

Intrathoracic fibroma is an extremely rare tumor. The authors present a case report of what they believe is the largest neoplasm of this type ever successfully removed. The point of origin could not be established, as the mass was densely adherent to the mediastinum and chest wall. The tumor on removal weighed 4,972 gm. The patient was a male forty-four years old who complained chiefly of progressive dyspnea for two years. Roentgenograms showed a mass occupying the entire right chest from the second rib anteriorly down to the diaphragm.

Although histologically benign, these tumors may become malignant clinically because of the size which they attain. It is suggested that routine roentgenograms of the chest of every person would enable earlier diagnosis of silent tumors, when they could be more easily removed. A classification of benign intrathoracic growths is presented.

HAROLD O. PETERSON, M.D.

Adenoma of the Trachea and the Bronchus. Leo Schwartz. Arch. Otolaryng. **39:** 231–242, March 1944.

The term "adenoma" as applied to endobronchial neoplasms embraces a large group of tumors which have been described as benign adenoma, polypoid adenoma, adenomatous polyp, adenoma of the bronchial mucous glands, carcinoid, benign epithelial tumor, benign glandular tumor, adenocarcinoma of low-grade malignancy, "tumor-like formation of inflammatory hyperplasia," endothelioma, mixed tumor, etc.

Bronchial adenoma may be pedunculated or may have a sessile base. The tumor with the thin pedicle, as a rule, grows entirely within the bronchial lumen. The intramural type presents a flat base and grows between the cartilaginous rings, elevating the mucosa inwardly and the fibrous membrane outwardly but remaining encapsulated within this limiting membrane. The endo-extrabronchial type has the configuration of a dumbbell, the smaller portion presenting endobronchially and the larger extrabronchially.

The signs and symptoms of bronchial adenoma are those characteristic of bronchial obstruction and depend on the location of the tumor, the type of obstruction produced, the amount of tributary alveolar tissue obstructed, and other factors, such as the type and virulence of secondary infection. Cough and profuse hemoptysis are the two most frequent and constant signs. On roentgen examination obstructive atelectasis is manifested by diminution in the alveolar capacity on the involved side of the thorax and elevation of the diaphragm on the same side. The ribs are arranged in a plane that is more vertical than the normal. The intercostal spaces are narrowed. The tracheal, mediastinal, and cardiac shadows are displaced toward the atelectatic side. The atelectatic lung often appears clouded as a result of pneumonitis or "drowned lung."

Obstructive emphysema is manifested by displacement of the heart and mediastinum toward the contralateral side or the side opposite to the obstruction. A roentgenogram taken on full inspiration will show full and equal expansion on the two sides; on full expiration, however, the abnormally ballooned obstructed lung fails to contract as does the normal unobstructed lung. The roentgen shadows of the heart, the trachea, and mediastinum are normally placed on inspiration; on expiration, however, these organs are forcibly pushed by the overexpanded lung into the opposite cavity. The intercostal spaces on the emphysematous side are widened as compared with those on the normal side, and the ribs assume a plane more horizontal than normal.

Bronchial adenoma is most frequently confused with bronchiogenic carcinoma. Adenoma is, however, overwhelmingly a disease of young women, while carcinoma occurs chiefly in old men. Hemoptyses occurring with adenoma are inclined to be more profuse than those with carcinoma. Adenoma does not metastasize nor does it infiltrate surrounding tissue, though it does recur and encroach on the adjacent lung. Frequently bronchoscopy alone can produce the correct diagnosis.

It seems likely that the tumors that arise from stalk-like bases and have neither mural nor extrabronchial extensions can be entirely cured by bronchoscopic means. This applies to the growth alone and not to pathologic states of the lung distal to the growth, which may demand more drastic treatment. Tumors which show mural and extramural extension and all cases complicated with irreparable pulmonary damage as a result of prolonged obstruction demand surgical intervention, with thorough eradication of diseased pulmonary tissue. Radium and roentgen therapy have proved entirely ineffectual in both the eradication and the retardation of growth of these tumors.

Three cases of adenoma of the tracheobronchial tree are reported. In 2 the tumor was in the bronchus; in the third case, in the extreme upper portion of the trachea.

Mediastinal Ganglioneuroma. Howard K. Gray, Duncan V. Shepard, and Malcolm B. Dockerty. Arch. Surg. **48:** 208—213, March 1944.

Ganglioneuroma is a rare tumor of the posterior mediastinum, but in the last twenty-five years the increasing frequency of thoracotomy has led to an increase in the number of cases so diagnosed. The clinical picture is vague and symptoms may be absent, the discovery being accidental. Pressure symptoms are the most common; there is occasionally a Horner's syndrome or a Pel-Ebstein type of fever. Roentgenologically the tumor appears as a smooth, homogeneous, ovoid shadow arising in the posterior thorax. No invasion of contiguous structures is seen, although invasion of the ribs and vertebrae may be present; pressure erosion may be demonstrated. Accurate preoperative pathological diagnosis is seldom made.

Treatment is surgical; irradiation is ineffective. While complete excision is desirable, the local adhesions of the tumor may make this impossible. The nearness of important vascular and nerve structures renders this the more difficult. Hemorrhage and infection are the two most dangerous complications of operation.

Grossly the tumor resembles a uterine fibroid. Microscopically, it consists of compact fusiform cells with round or oval, small, deeply staining nuclei. Islands of ganglion cells surrounded by satellite cells are scattered through the tumor. Nerve fibers are present, mostly non-medullated and arranged in bundles. Three cases are reported.

LEWIS G. JACOBS, M.D.

Mediastinal Lipoma. Case Report. William L. Watson and Jerome A. Urban. J. Thoracic Surg. **13:** 16–29, February 1944.

Intrathoracic lipomas usually arise in the mediastinum and are often considered congenital in origin. Up to 1941, 36 cases had been reported. Surgical removal is advocated even though the tumor is asymptomatic when diagnosed. There are three types, depending on location. In the first group are those limited to the thoracic cavity. The second group comprises those which extend into the neck, and in the third group are tumors of the "dumbbell" type, projecting through an intercostal space.

In one reported case a tumor was seen postmortem weighing 17 lb. 6 oz. In the case recorded here the tumor weighed 6.8 lb. and is the largest intrathoracic lipoma successfully removed. The patient was a woman forty years of age who had experienced some dyspnea on exertion all her life. This had become much more severe in the last year, with associated retrosternal pain, epigastric pain, dysphagia, nausea, and vomiting. Roentgenograms of the chest showed a tumor filling the entire left side except the apex above the first rib anteriorly. Visualization of the heart chambers was accomplished with 70 per cent diodrast. This showed no pulmonary circulation on the left side. The preoperative diagnosis was established by an aspiration biopsy. Postoperative roentgenograms show a progressive shift of the mediastinum into the left chest and the completely collapsed left lung never became aerated. A detailed account of the operation and postoperative course is presented.

HAROLD O. PETERSON, M.D.

Hemangioma of the Mediastinum: Report of a Case. W. E. Adams and R. G. Bloch. Arch. Surg. **48:** 126–129, February 1944.

Roentgen examination of a man 34 years old in the course of a health check-up showed an oval opacity occupying most of the left lung field. He gave a history of having a tumor removed from the base of the neck, on the left side, at the age of 18 months and again at 10 years. Examination now showed a firm mass in this region and signs of consolidation in the left chest. A

biopsy of the neck tumor led to a diagnosis of hemangioma with a dense fibrous stroma. The left bronchial tree was visualized with the aid of iodized oil, and found to be displaced posteriorly by a mass occupying the anterior half of the upper two-thirds of the chest. Pneumothorax demonstrated a few adhesions between the tumor and the diaphragm.

The larger part of the tumor was removed *via* the left pleural cavity, with a small piece of adherent pericardium; a small amount had to be left behind the clavicle. The postoperative course was rather stormy because of vasomotor instability and an attack of auricular flutter on the third day, but this responded to digitalization. A wound infection developed, necessitating removal of some small pieces of devitalized cartilage. The patient was discharged in six and a half weeks and has remained well for four years, except for a left vocal cord paralysis which developed postoperatively and has persisted. Microscopic examination of the tumor showed it to be a benign cavernous hemangioma with two areas of bone containing marrow.

LEWIS G. JACOBS, M.D.

Sarcoidosis of the Heart: Report of a Case and Review of the Literature. John B. Johnson and Robert S. Jason. Am. Heart J. **27:** 246–258, February 1944.

A case of generalized sarcoidosis is described in which massive infiltration of the myocardium was responsible for serious symptoms and caused the death of the patient, a male negro aged 24. A roentgenogram of the chest revealed enlarged mediastinal nodes with pulmonary infiltration and an enlarged heart. The postmortem findings are described in detail.

Eight cases of sarcoidosis of the heart were found in a review of the literature. Clinical evidence of heart disease was present in 3 of these, and sudden death occurred in another. The electrocardiogram showed no characteristic changes but in several of the cases of massive involvement there were pronounced abnormalities of the cardiac mechanism. The author believes that some cases recorded as atypical tuberculosis, specific myocarditis, granulomatous myocarditis, and myocarditis of unknown cause may in fact have been sarcoidosis of the heart. HENRY K. TAYLOR, M.D.

Atypical Coarctation of the Aorta, with Absence of the Left Radial Pulse. A. Grishman, M. L. Sussman, and M. F. Steinberg. Am. Heart J. **27:** 217–224, February 1944.

Coarctation consists of a narrowing, stenosis, or complete atresia of the isthmus of the aorta, usually beyond the origin of the subclavian artery and involving its orifice, but sometimes situated proximal to its origin. The wall is usually involved to an extent of 1 to 3 inches, or even more. Three cases with atypical symptoms are presented. In contrast to typical coarctation, there was no discrepancy between the blood pressures in the lower and upper extremities in these cases, no diminution of the femoral pulsations, and no retardation of the pulse wave in the lower extremities. Angiocardiographic studies verified the diagnoses.

Each of the 3 cases showed anatomically a relatively extensive involvement of the aorta at the isthmus and the distal portion of the arch, causing a slight narrowing. However, there was no obstruction to the blood flow in the thoracic aorta. This explains the fact that the relationship of the blood pressure in the lower to that in the upper extremities was normal, and that the pulse wave in the femoral artery was not retarded. However, in all three cases the orifice of the left subclavian artery was obstructed, resulting in almost complete absence of the left radial pulse. The origin of the left common carotid artery presumably, also, was narrowed, for there was a stenotic pulse, as well as a systolic murmur and thrill. In one case even the orifice in the innominate artery seemed to be involved. The aorta in another case was hypoplastic beyond the isthmus; the same patient also showed collateral circulation. Hypertension was present in two instances. Erosion of the ribs was not observed.

HENRY K. TAYLOR, M.D.

THE DIGESTIVE SYSTEM

Effect of Water Taken with Meals on Gastric Emptying. Edward J. Van Liere and David W. Northup. Gastroenterology **2:** 195–200, March 1944.

To determine the effect, if any, of drinking large quantities of water on gastric emptying, 21 normal medical students were given a test meal consisting of 15 grams of Quaker Farina, boiled in water down to a volume of 200 c.c. Fifty grams of barium sulfate were added so the position of the meal could be determined fluoroscopically. Several determinations of the normal gastric emptying time were made on each individual.

Nine subjects ate the test meal and drank 500 c.c. of tap water with it. It was found that the ingestion of this amount of water had no appreciable effect on the gastric emptying time.

Twelve subjects drank 1,000 c.c. of water with the test meal. The gastric emptying time of 11 of the subjects was not affected by drinking this quantity of water. One subject, however, showed a statistically significant decrease in gastric emptying time.

It was concluded that relatively large quantities of water taken with meals have no effect on gastric emptying time in the average subject, but an occasional individual may show some effect.

Gastric Fibrosis Involving the Duodenum. Daniel N. Silverman and Louis L. Friedman. Gastroenterology **2:** 186–190, March 1944.

A 40-year-old male complained of intermittent pain in the epigastric area during the past fourteen years, with a loss of 20 pounds in weight in that time. The pain was either gnawing or sharp and on occasion would radiate to the infrascapular area bilaterally and to the mid-line on the same level. It was so severe at times that the patient was unable to work or sleep; at other times there were complete remissions of all symptoms and the patient would enjoy a comparatively normal life. These periods of complete remission and exacerbation of symptoms varied greatly in length. Ingestion of any type of food during the attacks relieved the symptoms for about an hour, and the pain would then recur with greater intensity. The patient's appetite was good but he suffered from pyrosis, nausea, and occasional vomiting. There was never any hematemesis. Deep palpation in the epigastric area elicited severe pain. The abdominal musculature was spastic and relaxation could not be obtained. No abnormal masses were palpable. With the exception of a moderate hyperacidity, laboratory examinations were within normal limits.

Gastro-intestinal examination showed what appeared to be a benign polyp, about 2.5 cm. in diameter, in the antrum of the stomach adjacent to the pylorus, and a similar but larger and more irregular filling defect in the first portion of the duodenum, the walls of which were extrinsically smooth and well rounded. At six hours there was a 60 to 70 per cent gastric retention of the barium meal. Further fluoroscopic and x-ray examinations revealed a spastic type of colon. On gastroscopy the gastric mucosa was found to be normal with the exception of a small area on the anterior surface near the lesser curvature of the stomach, in the antral region adjacent to the pylorus. Here were multiple areas which gave the impression of being petechiae or minute superficial ulcers. The filling defect seen on x-ray examination appeared as a flat elevated submucosal tumor without any bridging of the mucosal folds.

A gastrojejunostomy was performed without difficulty. A stellate scar was found on the anterior surface of the duodenum; this was thought to be the site of an old ulcer. The duodenum was fixed by adhesions and could not be freed for removal. The wall of the duodenum appeared normal. The lesser curvature of the stomach on the anterior aspect near the pylorus felt thickened and fibrotic. The stomach was divided at the upper and middle thirds and resected. On gross examination the stomach wall was soft, with the exception of a small area in the antrum which sectioned with increasing resistance and was slightly firmer than the surrounding tissues. Microscopic examination showed an extensive fibrosis of the submucosa which extended between the muscle bundles and up to and including the subserosal area of the stomach.

The patient made an uneventful recovery and is now free of symptoms.

A small area of connective-tissue proliferation in the stomach, especially with extension into the duodenum, is rarely observed. The process is usually considered to be malignant, but serial sections through the entire segment of the stomach failed to reveal any malignant cells in this case.

X-Ray Appearances in Amoebic Hepatitis. J. Munk. Brit. J. Radiol. **17:** 48–53, February 1944.

Some cases of amebic hepatitis will show no evidence on roentgen examination. Occasionally gas may be identified in an abscess cavity and sometimes calcification may be observed in chronic cases. The signs commonly seen are indirect ones, as elevation or irregular bulging of the diaphragm, frequently with diminished motion and sometimes paradoxical motion. Pleurisy is sometimes seen, and there may be a zone of atelectasis just above the diaphragm.

These signs alone are not useful in the differential diagnosis, as many other conditions will produce them. When interpreted in the light of the clinical findings, they are helpful in confirming the diagnosis.

Ten cases are briefly reported with the roentgen findings. Roentgenograms are reproduced.

SYDNEY J. HAWLEY, M.D.

Radiological Anatomy of the Normal Terminal Choledochus. M. Royer and A. V. Solari. Gastroenterology **2:** 180–185, March 1944.

Two methods were employed by the authors in studying the radiological anatomy of the normal choledochus, —one, examination of autopsy specimens; the other, non-surgical cholangiography. Twenty-eight autopsy specimens—all normal—were studied radiologically by means of barium sulfate, three roentgenograms being made of each specimen, with 30, 50, and 80 cm. of water pressure. Non-surgical cholangiography, consisting of peritoneoscopy and injection into the gallbladder of an iodinized substance, under direct observation, was carried out in 15 cases.

Study of the terminal choledochus by these two methods showed it to have a characteristic appearance similar to the mouth-piece of a flute. This knowledge "is useful in distinguishing the normal from pathologic conditions of the terminal choledochus and diverticula of the second portion of the duodenum. A dilatation of the terminal choledochus (ampulla of Vater) was observed only rarely in the roentgenograms."

Polyposis of the Gallbladder: Case Report. J. Gregory Grego and Henry N. Harkins. Am. J. Surg. **63:** 398–401, March 1944.

A case of polyposis of the gallbladder is reported for three reasons: (1) its rarity; (2) its prophylactic importance, because of a possible predisposition of polypoid growths to carcinoma; (3) its interest, because of the preoperative roentgen diagnosis.

A 52-year-old female complained of bleeding from the rectum, weight loss, and abdominal distress. Examination revealed multiple polypoid growths in the rectal canal. On cholecystography the gallbladder shadow was clearly seen in the twelve- and sixteen-hour examination. A number of small negative shadows of sharp outline were present, somewhat different from the usual negative shadows due to gallstones, suggesting the possibility of polyps of the gallbladder. The rectal polyps were removed and the patient was discharged. There was no more rectal bleeding, but the abdominal distress continued. On readmission to the hospital cholecystectomy was done, and polyps of the gallbladder were found. No other pathological or surgical evidence of disease was discovered and the patient was subsequently free from symptoms.

The authors cite Kirklin's reports (Am. J. Roentgenol. **25:** 46, 1931 and **29:** 8, 1933) from the Mayo Clinic, where 8.5 per cent of more than 17,000 gallbladders surgically removed showed papillomas. Kirklin was able to make a correct roentgen diagnosis in many of these cases.

Malignant changes have been found associated with polyposis of the gallbladder but the etiologic association of carcinoma with papilloma has not been proved. Papillomas occur in the fundus and may give rise to symptoms of cholecystic disease.

G. A. CREEL, M.D.

Pancreatic Calculi: Report of Seven Cases in Two of Which Cure Was Effected by Pancreaticolithotomy. Joseph Lionello, Bernard J. Ficarra, and Nicholas H. Ryan. Arch. Surg. **48:** 137–143, February 1944.

The cause of pancreatic calculi is unknown but seems to be related to the stagnation of pancreatic secretions, resulting from inflammation and sclerosis. The stones are classified as true (in the ducts) and false (calcifications in the parenchyma). True calculi are usually smooth and rounded, rarely faceted; they vary in size and are usually found in the head of the organ. They are accompanied by a chronic interlobular pancreatitis

and fibrosis. Cysts or abscesses may form, and secondary changes in the liver and biliary tract, duodenal ulcer, or atheroma of the splenic artery may be associated.

The clinical picture is vague. Epigastric pain is the most prominent symptom, and loss of weight, diarrhea, a sense of epigastric pressure, and lowered blood pressure are sometimes present. The picture of a painful diabetes should suggest this condition.

The diagnosis is made by the roentgenogram; the stones are typically opaque and lie across the upper abdomen at the level of the second and third lumbar vertebrae. The condition is rare, only 232 cases having been recorded. Surgical removal of the stones is imperative to prevent further secondary changes. Two cases successfully operated upon and 5 diagnosed roentgenographically are reported.

LEWIS G. JACOBS, M.D.

THE SPLEEN

Calcification of the Spleen. Edwin F. Gray. Am. J. Roentgenol. **51:** 336–351, March 1944.

A group of 111 spleens from unselected necropsies were subjected to roentgen examination. Evidence of calcification was found in 63 of these. Most of the cases occurred in the fifth, sixth, and seventh decades. In 8 cases there was an active systemic tuberculosis, while many others disclosed evidence of apical scars or thickening of the apical pleura, possibly due to healed tuberculosis. Multiple calcifications of the so-called miliary type occurred in 58 cases. The lesions varied in size from 1 mm. to almost 1 cm. in diameter. Some were gelatinous and some extremely hard in consistency. On microscopic examination, the peripheral portion of the lesion is found actually to be a capsule of concentrically arranged hyalinized fibers. No iron pigment was present. No thrombosed vessels were associated with these lesions. No tubercle bacilli were found. Serial sections frequently disclosed bone formation in the core. The splenic pulp about the lesions was not distorted to any great extent.

There were 5 instances of calcium deposition within the capsule. Here the calcification was seen as a thin layer composed of granular deposits of calcium density distributed in a linear manner. No bone formation was noted.

Calcification occurred within an infarct in one case. The roentgenogram showed four triangular areas of calcification. There was no bone formation.

Calcification of the splenic artery was found in 5 cases. Roentgenograms showed circular or mottled shadows of calcium density in the course of the artery. These occurred in the hilum or in vessels within the splenic pulp near the hilum.

Gross and microdissection of calcified lesions furnished no direct evidence of a tuberculous or thrombotic origin. The multiplicity of the lesions is in favor of miliary tuberculosis as the etiologic factor, as is the presence of similar lesions in the liver. Guinea-pig inoculation was performed in 2 cases, however, and after eight weeks there was no evidence of tuberculosis.

Calcifications of infarcts, the capsule, and splenic artery usually occur in patients of advanced age.

The author gives a review of the literature on calcifications of the spleen, with a full bibliography, and three illustrative case reports.

CLARENCE E. WEAVER, M.D.

THE DIAPHRAGM

Roentgen Diagnosis of Some of the Lesions Adjacent to and Involving the Diaphragm. Eugene P. Pendergrass. Pennsylvania M. J. **47:** 587–590, March 1944.

Next to a good history, the roentgen examination is probably the most valuable single procedure in the diagnosis of lesions in and around the diaphragm. The examination should include fluoroscopy in the erect position if possible and roentgenography of the chest and upper abdomen in the erect position, as air and fluid levels are sometimes the only clue to the diagnosis. Films should also be made in the horizontal position to demonstrate the soft-tissue outlines of the kidneys, liver, spleen, and muscles.

Barium may be used to outline a hernia of the diaphragm when the stomach or colon is found in the thorax. Pneumothorax and pneumoperitoneum may at times be used; in the latter procedure the danger and pain will be obviated if CO_2 is used instead of air. Hepatosplenography with thorotrast (75 c.c. intravenously) will produce dense shadows on the roentgenogram, representing the liver and spleen. Abscesses and metastatic lesions do not cast shadows and may be demonstrated in this manner.

The dome of the right diaphragm is usually about 1.5 cm. higher than the left dome; the domes are usually smooth in outline and irregularity in their contours may be due to adhesions or variation in attachment or size of the constituent muscle bundles. Occasionally one finds a rounded lump on the mesial aspect of the dome of the right diaphragm. This may be due to a weakness of the diaphragm, or the inferior vena cava may prevent its downward excursion. Tumors of the liver and subphrenic lesions will give a similar appearance.

An anomalous enlargement of the right lobe of the liver will produce a shadow in the lateral view that may simulate that of an interlobar collection. The posterior costophrenic sulcus is much lower than the anterior and fairly large localized collections may escape detection unless the patient is examined in the lateral position. A slight restriction in the movement of the diaphragm should, if possible, be studied in the erect position, as the domes of the diaphragm are higher and the excursion is greater when the patient is in the horizontal position. This is particularly true in infants and young children.

Diaphragmatic elevation, either bilateral or unilateral, may be found after an abdominal operation and may have no pathological significance. Paradoxical movement of a diaphragm is now commonly seen due to the frequency of phrenic operations.

Kidney and perinephric lesions which cause localized elevations of the diaphragm are best seen in the lateral view. Tumors are not likely to cause fixation of structures; inflammatory lesions often do and may produce an elevation of both domes of the diaphragm. Unless one employs thorotrast or pneumoperitoneum for demonstration of the liver, the roentgenographic impression of its size may be deceiving.

Calcification in the liver is, in the experience of the author, caused most frequently by a primary tumor or echinococcus cysts. The latter are usually multiple.

Small dense spots frequently seen in the spleen may be due to phleboliths, calcified tubercles, fungus infections, or primary tumors.

Soft-tissue outlines are obscured in ascites, and loss

of the psoas outline may be due to an inflammatory or a malignant lesion. JOSEPH T. DANZER, M.D.

THE SKELETAL SYSTEM

Congenital Absence of the Patellae Associated with Arthrodysplasia of the Elbows and Dystrophy of the Nails: A Hereditary Syndrome. Hyman R. Senturia and Ben D. Senturia. Am. J. Roentgenol. **51:** 352–358, March 1944.

After reviewing the literature on the hereditary syndrome described in the title the authors state that, although there has been some variation in the nature and degree of the congenital defects which have been described, the localization of the abnormalities to the nails, particularly of the thumbs, to the patellae, and to the elbows has been fairly striking.

The typical dystrophic nail presents a small normal appearing base that is much thinner than normal and that gradually disappears about half way down the nail bed. Occasionally the nails of the toes are affected. The patella may be absent altogether or show at least severe hypoplasia. Roentgenograms of the elbow reveal an arthrodysplasia characterized by an elongation and deformity with luxation of the proximal end of the radius. The head of the radius is poorly formed.

A case is cited presenting the classical triad of deformities. The patient was a male, aged 36, whose great-great-grandfather was known to have had this affection. After three generations the condition reappeared, in the patient's mother, and 29 persons were affected in the three succeeding generations.

It is apparent from the literature on this subject that we are dealing with the hereditary transmission of a dominant character, not sex-linked, the anomaly being carried at the same time in two different systems, one derived from the mesoderm, the other from the ectoderm. Aschner (J. A. M. A. **102:** 2017, 1934) concluded that the genes for the defect of the patella and the thumb nail are not only linked together in the same chromosome, but are even very near neighbors to each other within the chromosome. The gene for the luxation of the head of the radius is probably in the neighborhood of the other two genes, but not quite so close in the chromosome, as the whole syndrome does not occur so often as the association of the defect of the thumb nail and the patella.

A bibliography is appended.

CLARENCE E. WEAVER, M.D.

Arachnodactyly in Four Siblings, with Pneumoencephalographic Observations of Two. Harry D. Pasachoff, M. J. Madonick, and Carl Drayer. Am. J. Dis. Child. **67:** 201–204, March 1944.

Arachnodactyly, or Marfan's disease, is characterized not only by the long, slender bones of the hands and feet, which give it its name, but also by muscle atrophy and laxity of ligaments permitting skeletal deformities and anomalies of the eye and heart. The commonly described deformities are kyphosis, scoliosis, funnel chest, high position of the patella, hammer toes, pes planus and subluxation of the joints. Ocular abnormalities include dislocation of the lenses, tremulous irises, myopia, miosis, shallow anterior chamber, and strabismus. Patent interventricular septum and patent ductus arteriosus are the more common cardiac findings. Dolichocephaly, enlargement of the ears, and a melancholy expression may be present. Intelligence, as a rule, is good. Hereditary background is found in many instances. Roentgen examination shows the phalanges, metacarpals and metatarsals to be longer than is usual but reveals no abnormal changes in bone structure anywhere.

Two typical cases of this disease occurring in a brother and sister are described. Both children were retarded mentally. Encephalograms, believed to be the first recorded in the literature in this condition, showed moderately dilated lateral ventricles with no displacement. The remaining two children in the family were found to be similarly afflicted and information concerning the hereditary background revealed elements of the disease in the father and paternal grandfather. No cardiac anomalies were observed in any of the children.

LESTER M. J. FREEDMAN, M.D.

Case of Morvan's Type of Syringomyelia. Nathan Bloom and Lloyd J. Moss. Virginia M. Monthly **71:** 131–133, March 1944.

The classical syndrome of Morvan's type of syringomyelia is seen in young persons and consists of initial pain about the shoulders and arms, followed by loss of pain and temperature sensation, with retention of the sense of touch and subsequent trophic changes of the bony structures. Painless indolent ulcers of the fingers and hands are common. Morvan's type of syringomyelia is less often seen than the various other forms.

The authors' patient was a 49-year-old colored woman with a history of a severe infection of the right hand six years before. Both hands and wrists increased in size, with gradually developing stiffness and flexion of the fingers of the right hand. Loss of sensation resulted in frequent burns and cuts, with slow healing. Numbness and tingling occurred in both upper extremities with occasional vague pains in the wrists or fingers. Some disability of the right hand was present on account of the flexion deformity, but there was no definite motor weakness or muscle twitching.

On admission, the hands and wrists were huge and deformed by swelling. The fingers were sausage-shaped and several indolent ulcers were present on the right hand, which was held in a flexed, stiffened state. Both wrists were unusually mobile and crepitant but were not tender or painful on motion. The biceps and triceps reflexes were absent. All other reflexes were normal and there were no pathological reflexes. The vibratory sense was intact throughout the body, and position sense was normal. Pain and temperature sensations were lost in both hands and wrists and were diminished above the wrist and on the trunk to the level of the twelfth dorsal segment. Below this segment, sensations were normal. The standard laboratory findings were essentially negative.

X-ray examination revealed a dorsal scoliosis with convexity to the right and slight lumbar scoliosis with rotation of vertebral bodies. The left third rib posteriorly was fractured. In the hands there was disorganization, with old fractures, of both wrists and a tendency toward "claw" hands, slight erosion of the terminal phalanges, and soft-tissue swelling. The patient received large doses of thiamin hydrochloride and deep x-ray therapy and seemed to improve.

The author points out that the joint changes described as "Charcot joints" may be due to direct

injury to the spinal cord, as in stab wounds, myelitis, spina bifida, and other cord lesions, and that such arthropathy is not always of syphilitic origin.

J. E. WHITELEATHER, M.D.

Pulmonary and Osseous Manifestations of Tuberous Sclerosis, with Some Remarks on Their Pathogenesis. Alfred J. Ackermann. Am. J. Roentgenol. **51:** 315–325 March 1944.

According to our present conception, tuberous sclerosis is a form of congenital ectodermosis, as are three other outstanding entities, namely von Recklinghausen's neurofibromatosis, angiomatosis cerebri, and Hippel-Lindau's disease. In fully developed cases one finds most frequently the following symptoms: (1) epileptic seizures; (2) mental deficiency; (3) cutaneous lesions, and (4) congenital tumors of the eye and many visceral organs. Clinical manifestations of the disease are often recognizable in infancy. They depend upon the organs involved.

Pathologically, tuberous sclerosis is characterized by the presence of potato-like tumors, varying in size from 0.5 to 3.0 cm. in diameter. These tumors occur most frequently in the cerebral hemispheres. In the walls of the third and lateral ventricles, immediately beneath the ependyma, small irregular projections are found, arising usually from the thalamus, The microscopic alterations characteristic of the disease affect the pyramidal cells and the glia. Giant cells lie typically in the depth of the sclerotic nodules, *i.e.*, where the neuronic and glial changes are most intense. A large cell of neuronic type and a large cell with glial resemblance are distinguished.

Histopathologic studies of pulmonary and osseous manifestations of tuberous sclerosis have been scant. Berg and Zachrisson (Acta radiol. **22:** 425, 1941) emphasized the irregular, honeycomb-like pattern in both lung fields, made up of scarcely visible to hazelnut-sized translucencies, separated by fine round striae. Skeletal involvement has been reported by various authors, whose observations are reviewed. A close study of the osseous changes reveals that they are not uniform. One finds bone sclerosis, periosteal thickening, bone rarefaction, and cyst formation. These changes may be an expression of physiopathological disturbance rather than of embryonal tissue dysplasia. The cases exhibiting skeletal changes showed the tubera to be located in the floors of the lateral ventricles and within the third ventricle. In other words, the lesions involved the thalamic and hypothalamic area of the brain. The significance of the hypothalamus in skeletal disorders has recently been emphasized by Lichtwitz (Functional Pathology, New York, Grune and Stratton, Inc., 1941). The polycystic lung disease is considered to be an expression of "embryoplasmatic dysplasia," a condition due to an anomaly of fetal differentiation.

A case is reported of a white male, aged 25 years, who complained of polyuria, nocturia, and pain in the chest, back, and both legs. Roentgen examination showed a honeycomb pattern of the lung fields with numerous multi-angular areas of increased translucency, separated by thickened fibrous strands. Skeletal changes consisted of erosion of the first lumbar segment with accompanying sclerosis. There were numerous cystic areas within the iliac, ischial, and pubic bones and in both femora. Blood calcium and phosphorus levels were normal. Blood chemistry did not support a possible diagnosis of osteitis fibrosa cystica due to hyperparathyroidism. There was no demonstrable disturbance of the lipoid metabolism. The patient was observed over a period of eight years.

CLARENCE E. WEAVER, M.D.

Gargoylism: Review of Literature with Report of Two Cases. Louis A. Lurie and Sol Levy. Am. J. M. Sc. **207:** 184–195, February 1944.

The syndrome, variously called "gargoylism," dysostosis multiplex, Hurler's syndrome, and lipochondrodystrophia, is characterized by chondrodystrophic skeletal changes and deposition of a lipid-like substance in many of the body tissues.

Cases in two brothers, aged seven and six, are presented. The patients stood with all joints stiffly flexed. The head was retracted backwards and rested on the shoulders; it was larger than normal, with prominent bosses. The orbits were wide-set, the nose was saddle-shaped, and the lips were thick. A thoracolumbar kyphosis was present. Each patient had a barrel-shaped chest. Enlargement of the liver and spleen and umbilical herniae were present. Both patients showed hypertrichosis of the back and extremities. Corneal clouding, which is present in 75 per cent of the cases, was absent. There was laboratory evidence of definite liver damage.

The disease is congenital and familial in origin, affecting both sexes. Consanguinity plays no role; neither are the parents mentally defective. Usually, no abnormalities are present at birth, symptoms appearing between the first and second years, when a failure of normal development is observed. The condition is a lipoid disturbance, since abnormal storage of lipoid substances has been found, principally in the reticuloendothelial cells, brain, cornea, pituitary, liver, spleen, and lymph nodes. These deposits appear as fine curved rod-like granules of as yet undetermined nature.

Roentgenographically, the skull is large and the sella is proportionately larger. The vertebral bodies may be poorly developed or even deformed. Bone ossification is retarded. The changes in the skull are probably not due to the lipoid disturbance, but rather to a defect in the mesodermal anlage and faulty development of the sphenoid; the vertebral anomalies are probably attributable to faulty formation of the cartilage, while the retarded bone growth may be due to a pituitary factor. The restricted motion in the joints may be due to poor formation of the articular surfaces.

In Morquio's disease, from which gargoylism must be differentiated, there is no limitation of motion of the joints and the patients are not feeble-minded.

BENJAMIN COPLEMAN, M.D.

Hand-Schüller-Christian's Syndrome and "Eosinophilic or Solitary Granuloma of Bone." Oscar Versiani, José Maria Figueiró, and Moacyr A. Junqueira. Am. J. M. Sc. **207:** 161–166, February 1944.

A woman aged 50, who also complained of polydipsia, suffered a pathological fracture within a year after a rarefied area was found in the middle of the left femoral shaft. All the other long bones were normal. A moderate anemia was present. The white cell count showed 6.5 per cent eosinophils.

A biopsy was performed, and a certain zone in the biopsy material showed an accumulation of eosinophils,

giving the picture of eosinophilic granuloma; another zone showed lipophages arranged like a lipogranuloma. Cellular hyperplasia and reticular thickening were apparent.

The authors believe that eosinophilic granuloma and Hand-Schüller-Christian's disease should be regarded as manifestations of the same process.

BENJAMIN COPLEMAN, M.D.

Eosinophilic Granuloma of Bone: A Condition Affecting One, Several or Many Bones, but Apparently Limited to the Skeleton, and Representing the Mildest Clinical Expression of the Peculiar Inflammatory Histiocytosis Also Underlying Letterer-Siwe Disease and Schüller-Christian Disease. Henry L. Jaffe and Louis Lichtenstein. Arch. Path. **37:** 99–118, February 1944.

Eosinophilic granuloma of bone is seen mainly in children and adolescents, and sometimes also in young adults. One, several, or even many bones may be involved. With the possible exception of the hands and feet, almost any bone apparently may be the site of a lesion. In the cases in which more than a few bones are involved, those affected are likely to include one or more bones of the cranial vault, some of the ribs, one or more of the vertebrae and several of the long bones—especially the humerus and femur.

Clinical difficulties are usually limited to such local complaints as may arise from the skeletal lesions, systemic manifestations being entirely absent as a rule, even in the cases with multiple bone involvement. In these latter cases the clinical symptoms may be referable to a single lesion, all the others being silent at first or even consistently. Local tenderness and pain are the most common symptoms referable to an affected bone. In an occasional case, leukocytosis of moderate severity but not associated with any change in the differential count may be found. In some instances whether or not there is a leukocytosis, the differential count shows a slight increase of eosinophilic leukocytes.

There is nothing distinctive about the roentgenographic appearance of the individual lesion of eosinophilic granuloma. In cases involving a single bone the focus of destruction may, especially in light of the clinical picture as a whole, resemble a primary cancerous growth. In cases where several or many bones are involved, the roentgen appearance may suggest multiple myeloma, Ewing's tumor, skeletal metastases and, particularly in the presence of lesions in the skull, Schüller-Christian disease.

In general, the individual lesion presents itself roentgenographically as a small or large radiolucent zone. In the calvarium the lesions tend to appear more or less circular and rather sharply delimited, the zone of rarefaction even looking punched-out. Extensive resorption of the tables, particularly the outer table, will generally be found associated with swelling of the overlying soft parts. In a scapula or an innominate bone, too, the lesion tends to appear on the film as a rather circular, almost punched-out area of rarefaction. In a rib, the affected area, in addition to being rarefied, may be expanded and also fractured, and if fracture is present there may even be evidence of periosteal deposition of new bone and thickening of the overlying soft tissue. In the long bones, the lesion begins to evolve in the interior of the bone; as it enlarges, implicating the neighboring cortex, the latter becomes eroded from the inside. The cortex may become expanded and even perforated, and where perforation has taken place, deposition of periosteal new bone may be observed.

On pathologic study a skeletal lesion in an early phase appears grossly as a more or less hemorrhagic and cystic area from which only a relatively small amount of granulation tissue can be curetted. This tissue, where it is not necrotic, is found to contain conspicuous numbers of histiocytes, including some revealing phagocytic activity, interspersed among which are more or less prominent accumulations of eosinophils, especially eosinophilic leukocytes.

Eosinophilic granuloma of bone, Letterer-Siwe disease, and Schüller-Christian disease may be considered as different clinico-anatomic expressions of the same basic disorder. This disorder apparently represents a peculiar inflammatory reaction to some as yet unknown agent of infection, and its individual lesions are characterized cytologically by the presence, at least at first, of large numbers of histiocytes. In eosinophilic granuloma of bone the lesions seem to develop only in the skeleton and often in a single bone, and are given a distinctive cytologic imprint by the abundance of eosinophils intermingled with the histiocytes. The lesions do not tend to become scarified, collagenized and lipidized, heal rapidly after simple curettage even without supplementary roentgen irradiation of the site, and may indeed heal by resolution without any therapeutic intervention whatever.

In Letterer-Siwe disease the histiocytic lesions are widely distributed through the soft tissues (especially the lymphoid tissues) and the skeleton, the marrow sometimes being extensively affected even when there are few actually destructive lesions in the bones. With widespread involvement of the bones of the skull, Letterer-Siwe disease may even come to present the complete Christian triad—calvarial defects, diabetes insipidus, and exophthalmos. Though the lesions in the soft tissues in cases of Letterer-Siwe disease do not show infiltration by eosinophils, the destructive lesions of bones do show it, especially early in their evolution. Indeed, the granulation tissue in such destructive lesions of Letterer-Siwe disease is indistinguishable microscopically from such tissue in corresponding lesions of eosinophilic granuloma of bone. In a case of Letterer-Siwe disease running a relatively protracted course of a year or more one is likely to find that some of the lesions (especially those in the skeleton and those in the thymus and lungs) are becoming scarified, collagenized and lipidized, the case thus passing over into the domain of Schüller-Christian disease.

Schüller-Christian disease represents the basic disorder in its most chronic and on the whole most miscellaneous form, the presence or the absence of the Christian triad depending merely on whether or not the skull has been heavily involved. However, any case which is placed in this category should be expected to show, as the anatomic prerequisite, at least some lesions which have already become scarified, collagenized, and lipidized and are hence classifiable as lipogranuloma.

Renal Rickets Syndrome. W. G. Hayward. J. Urol. **51:** 278–286, March 1944.

The author presents two cases: one of dwarfism, bilateral hydronephrosis, moderate disturbance of calcium-phosphorus ratio, and no bone changes, with

improvement following operative correction of renal and ureteral anomalies; the second, of dwarfism, hydroureter, osteoporosis and epiphyseal changes, and high serum phosphorus, terminating fatally.

Renal rickets is a disease of youth, the average age of onset being twelve or fourteen years; it occurs equally in boys and girls. Typically it is characterized by dwarfism; usually bright mentality; bony changes, chiefly genu valgum, which is present in about half the cases; roentgen findings suggestive of ordinary rickets; thirst, polyuria, dry skin, anorexia, headache, delayed sexual development, and in various degrees poor renal function, azotemia, a low serum calcium and high serum phosphorus. The three outstanding features are the dwarfism, rachitic changes, and the calcium-phosphorus reversal.

Any renal disease which causes retention of phosphorus may lead to renal rickets. Under these conditions phosphorus is eliminated into the bowel, where it combines with calcium to form insoluble calcium phosphate. This the bowel cannot absorb, and reduction in serum calcium results. The excessive phosphorus causes hyperplasia of the parathyroids, which in turn creates decreased density of bones with fibrosis and cystic changes. Large parathyroids have been found at autopsy. Some writers feel that imbalance of the calcium-phosphorus ratio is more important than the total amounts of the elements. Tetany is very rare, apparently because the serum calcium never falls low enough.

Prognosis is almost 100 per cent unfavorable. Only two years of life are to be expected after bone changes occur. EDWIN L. LAME, M.D.

Osteomyelitis of the Odontoid Process of the Axis (Dens of the Epistropheus). T. J. F. Frank. M. J. Australia **1:** 198–202, March 4, 1944.

Acute osteomyelitis of the vertebrae is a rare disease. The site of the infection in the vertebral body, laminae, and processes is usually more important than the part of the spinal column affected. If the focus is localized in the anterior part of the body or on the periphery of the vertebra or lamina, the infection is more apt to follow the fascial planes and spinal muscles with the production of better opportunities for eventual drainage of an abscess. Lesions of the spinous and transverse processes may finally result in superficial abscesses, which can be easily drained. If the disease affects the posterior part of the vertebral body or the inferior surface of the lamina, meningitis or meningomyelitis may arise through direct spread of the infection or from rupture of the pus into the spinal canal.

Osteomyelitis of the spine is usually the result of a blood-borne infection from a primary focus elsewhere. The organisms most commonly found are *Staphylococcus aureus* and *albus*, the pneumococcus, the streptococcus, and *Bacillus typhosus*.

Acute osteomyelitis of the vertebrae may occur at any age before their ossification is complete and sometimes later. Twelve to fifteen years has been given as the age of election. The mortality is high, averaging about 45 per cent.

Involvement of the cervical vertebrae is especially rare. It may be mistaken for spontaneous hyperemic dislocation of the atlas, which is also unusual.

A case is reported in a man 43 years of age. The right index finger became swollen and this was followed by cellulitis of the hand and forearm, which responded to multiple incisions and sulfapyridine. Two weeks later the left ankle became painful and swollen. Later there was transient pain in the groin, and two weeks afterward the neck became stiff and painful. A few enlarged cervical nodes were present. The blood count showed evidence of infection. X-ray examination of the neck was negative at this time. Two weeks later, however, some osteoporosis of the odontoid was demonstrable and a diagnosis of osteomyelitis was made. Examination by x-ray nine days later did not show any additional bony changes, but in another twelve days roentgenograms revealed a pathological fracture of the base of the odontoid process, which was displaced a quarter of an inch to the right. Lumbar puncture yielded clear spinal fluid, containing a few white cells but no increase in globulin.

The patient died seven weeks after entering the hospital. Postmortem examination showed a thick-walled abscess in the left upper lobe of the lung. The peritoneal sac contained several pints of clear yellow fluid. Large perinephric collections of green-yellow pus were found, and there were several abscesses in each kidney. The cultured organism was *Staphylococcus aureus*. The odontoid process of the axis was congested, rarefied, and eroded, and a complete fracture was present just below the level of the articular surface. Microscopic examination of the odontoid process revealed an acute osteomyelitis.

DONALD R. LAING, M.D.

Role of Aseptic Bone Necrosis in Hip Lesions. Ernst Bergmann. Am. J. Surg. **63:** 218–235, February 1944.

Because of the arrangement of vessels supplying the head of the femur, impairment of the blood supply with consequent aseptic necrosis is of particularly frequent occurrence at this site.

In *fractures of the femoral neck* the blood supply to the head is either greatly impaired or altogether cut off and aseptic necrosis ensues. Too much significance need not be attached to this, however, so far as immediate healing is concerned, for with proper reduction the chances for bony union are still good, since the adjacent living bone of the distal fragment can unite with the head before this has gone through all the stages of reorganization. The true significance of aseptic necrosis in fractures lies rather in the possibility of late damage —the collapse of an area of residual necrosis one or two years after bony union is complete. This may occur after any of the approved methods of treatment, and no means of predicting or preventing it are known.

Epiphyseal separation may or may not be accompanied by ischemic necrosis. On the whole, its role is a minor one. The author cites one case in which, six months after apparent healing, the entire epiphysis collapsed. In another case, three years after reduction, evidence of residual necrosis was observed roentgenologically, though due to its position in a sector not subject to full weight-bearing pathological fracture did not occur. Forceful manipulation of slipped epiphyses should be avoided, as this may jeopardize what remains in the way of blood supply or has been re-established through adaptation.

In *traumatic dislocation* of the hip, as in fractures, wedge-shaped areas of necrosis may persist and collapse after a considerable interval, under the strain of weight-bearing. In *congenital hip dislocations* the capsule is intact and the capsular vessels have time for

the necessary adjustment, but even so an occasional case shows a necrotic area after the patient has reached adult life.

Perthes' disease differs from the conditions previously described in the absence of any frank traumatic factor; yet autopsy and surgical specimens reveal the characteristics of aseptic bone necrosis. The explanation of these changes is not clear. Minor repeated or permanent mechanical effects, such as are associated with almost normal activities—so-called "microtraumata"—have been suggested as a causative factor.

The loose bodies or joint mice characteristic of *osteochondritis dissecans* show under the cover of living articular cartilage a necrotic bony core. Here, too, a satisfactory explanation is wanting, but mechanical effects seem to play a role.

Only in *caisson disease* is embolic interruption of the circulation unquestionably accepted as the cause of the subsequent aseptic necrosis.

Osteoarthritis may be accompanied by collapse and demarcation of areas of necrotic bone in the weight-bearing sector but, as in osteochondritis dissecans, the explanation is a matter of conjecture.

Finally, the author mentions tuberculosis of the femoral head. "Certain forms of epiphyseal tuberculosis," he says, "due to vascular occlusion through embolism by tuberculous material may be accompanied by anemic infarcts of truly aseptic type."

Roentgenographic Diagnosis of Torsional Deformities in Tubular Bones. Henry Milch. Surgery **15:** 440–450, March 1944.

Commonly, the determination of rotational displacement of the long bones depends upon exposure of the entire bone to roentgen beams which diverge from each other by known angular amounts. While this method affords an excellent opportunity for the scientific measurement of the degree of rotation of a known anatomic prominence, such as the femoral neck, it is not always conveniently applicable, particularly when there has been a loss of continuity in the shaft of the bone. From a practical point of view, it is seldom, if ever, necessary to determine the degree of such rotations with mathematical precision, provided the direction can be accurately demonstrated. The author presents "a few simple observations" which have been found helpful.

In recent fractures the presence of rotation of one fragment upon the other around a longitudinal axis must be envisaged when a disproportion persists between the fracture ends. In the absence of any marked telescoping of the bone ends, this appearance can arise only from a rotational displacement, since long bones are, in general, irregularly polygonal or elliptical, but almost never truly circular in outline.

Failure to recognize the presence of rotation may account in no small measure for the difficulty experienced in the treatment of spiral or malleolar fractures of the tibia, fractures of the femoral neck, and especially supracondylar fractures of the humerus. In the latter case, the thinness of the bone in the supracondylar region makes the retention of end-to-end reduction most precarious and it is probably because of the persistence of some rotation that more marked displacement can be avoided.

Rotation of the fragments of a supracondylar fracture is betrayed by cross-sectional disproportion. The direction of rotation, however, requires other observations. These are based upon the principle of determining the projection relationship between two transverse axes which normally converge at known angles. In the case of the femur these are the bicondylar axis and the axis of the femoral neck.

Using the direction of any normal bony projection as an axis of reference, the same method for the determination of torsion can be applied to all the long bones. Once the normal angular relationship of the prominence to any other transverse axis is known, torsion existing between the two axes can be roentgenographically established and, if necessary, measured. However, it is essential that the whole bone be radiographed on a single plate, since both axes of reference must be projected on the same film.

In the humerus, the lower or bicondylar axis is preferable to the upper axis because of the shortness of the humeral neck. The axis of the head and neck is retroverted and makes a backward and inward angle of about 20 degrees. Hence, the neck should always be foreshortened in relation to the bicondylar axis when the fragments are in normal alignment.

Examination of the ulna discloses that in its anatomic position the coronoid process points almost directly forward, while the styloid process, at its distal end, points almost directly backward. It follows, therefore, that the clear outline of the styloid process on a routine anteroposterior view and its absence on a routine lateral view are pathognomonic of torsion in the ulna.

In the radius, the situation is exactly opposite. The absence of the radial styloid process in a routine anteroposterior view and its presence on a routine lateral view are pathognomonic of torsion.

In the leg, because of the absence of prominent lateral projections, the roentgenographic recognition of torsion is somewhat more difficult. The medial projection of the internal malleolus is so slight as to make it practically valueless for establishing an axis of comparison with the bicondylar axis of the tibia. However, the method here described can be employed with slight modification. On a true lateral view, with the axis of the knee joint perpendicular to the roentgen film, the long axis of the fibula normally lies posterior to the longitudinal axis of the tibia. This is, of course, due to the fact that the bimalleolar axis of the ankle joint is normally externally rotated 20 to 25 degrees from the bicondylar axis of the tibia. Using this relationship as a norm, it will be seen that external rotation of the tibia serves to increase the apparent displacement of the fibula on the lateral roentgenogram of the tibia. Internal torsion, on the other hand, results in a relative forward displacement of the malleolar head in the lateral view. The demonstration of this phenomenon, however, depends upon securing an absolutely true lateral view of the upper end of the tibia, as a norm, against which comparison may be made.

J. E. WHITELEATHER, M.D.

Fractures of the Tibial Condyles. Wm. L. Weber. California & West. Med. **60:** 96–98, March 1944.

Fractures of the tibial condyle may be the result of indirect or direct violence. The indirect type of fracture is the result of falling upon the feet with the leg in extension, or of forcible abduction or adduction at the knee with the leg fixed. Direct violence includes severe blows and crushing injuries just below the knee joint. The so-called "bumper" fracture is an example.

The joint surfaces are involved in nearly all tuberosity fractures and the horizontal plane of the tibial condyle is in malalignment. The head of the fibula may be fractured, too.

Roentgenograms are essential in determining the extent of the fractures and the type of treatment. Therapy is conservative. The author uses a modified Forrester technic. Early motion is advocated, but weight-bearing is never begun before six to eight weeks have elapsed, and then only with the protection of a long caliper brace. The author does not advise immediate open reduction.

MAURICE D. SACHS, M.D.

Combination of Nail and Screw for the Fixation of Fractures of the Neck of the Femur. Herbert A. Johnston. Am. J. Surg. **63:** 329–336, March 1944.

The author describes his method for the fixation of hip fractures, using a combination nail and screw. This screw has a channel from end to end so that it readily follows a guidewire. It also has a slot from end to end for the reception of a key, which is the same length as the screw and is easily inserted. The key is thicker on the inner border and is made to fit the guide-wire channel. It is flat and when inserted projects through the slot from end to end of the screw. It is driven in after the screw is inserted. The screw provides compression of the fragments and the key becomes a flange which prevents its change of position and also prevents rotation of the head.

This device may be inserted by any method of choice —large incision or small puncture. The author uses a puncture operation, inserting the screw under fluoroscopic guidance. With the technic which he describes, the periods of exposure to x-rays are brief and the operator's hands are well out of the field of danger, so that he runs no serious risk.

Pneumoroentgenography of the Knee Joint. P. P. Hauch. Brit. J. Radiol. **17:** 70–74, March 1944.

The technic employed by the author for pneumoroentgenography of the knee joint is as follows. Under aseptic precautions 100 to 140 c.c. of oxygen are injected into the knee joint and a snug elastic bandage is applied. Radiographs are made in the posterior-anterior projection of each half of the joint in forced abduction and adduction. Oblique, lateral and antero-posterior views are also taken if indicated. Better results are obtained if the films are slightly over-exposed and under-developed. Oxygen is used in preference to air, as it is more quickly absorbed. There is no undue pain or discomfort during or after the procedure.

It is possible to identify tears and hypermobility of the menisci, loose bodies, injuries to the cruciate ligaments, injuries to the cartilages of the femur and tibia, hypertrophy of the fat pads, calcification of the menisci, cysts, and minute fractures. In a series of 21 cases the procedure described was found to be highly accurate.

SYDNEY J. HAWLEY, M.D.

Soft Tissue Complications of Fractures of the Leg. A. B. Sirbu, M. J. Murphy, and A. S. White. California & West. Med. **60:** 53–56, February 1944.

Valuable time is lost in the treatment of fractures by paying too much attention to bone fragments and giving inadequate consideration to the extent of injury to adjacent soft tissues and the sympathetic nervous system. During the past two years the authors have been collecting a series of cases involving trauma of the extremities with vascular complications. These include (1) generalized arterial occlusion of the leg due to vasospasm; (2) Volkmann's ischemic paralysis of the leg with gangrene of the anterior crural muscles; (3) localized gangrene of the anterior tibial muscle.

Eight illustrative cases are presented. The role that the sympathetic nervous system plays in the production of arterial spasm and the relationship of the latter to ischemia and even gangrene of an extremity are discussed.

The authors state that in all traumatic injuries of the extremities a careful search should be made for evidence of vascular and nerve involvement; that evidence of arterial spasm, either as an early or delayed complication, should be sought; that a lumbar sympathetic or stellate ganglion block should be done in all cases of circulatory impairment and, if that is not satisfactory, a periarterial sympathectomy or arteriectomy should be performed.

MAURICE D. SACHS, M.D.

Subastragaloid Dislocation. Report of an Unusual Ski Injury. Merle J. Brown and Walter E. Brown, Jr. Am. J. Surg. **63:** 276–277, February 1944.

A case of subastragaloid dislocation of the left ankle occurring during military skiing is reported. While coming down a hill at a moderate speed, the patient lost control and began to fall. The front end of the ski caught in a tree. As the forward momental force carried the weight of the body past the tree, a torsion external rotating force was produced on the left ankle. Examination immediately following the accident showed a deformity of the left ankle with the foot projecting at a 90° angle lateralward in relation to the leg, with general diffuse swelling. Roentgenograms showed a complete dislocation of the os calcis on the talus, with 90° lateral rotation of the foot, the scaphoid bone being separated anteriorly from the talus. Successful reduction was finally accomplished, as shown by x-ray examinations, and a cast was applied. An x-ray check-up two weeks following the accident showed a normal left ankle joint. The patient was discharged to full duty approximately four weeks after the injury. Roentgenograms are reproduced.

Vertebral Fractures in Metrazol Therapy With and Without the Use of Curare as a Supplement. N. L. Easton and Joseph Sommers. J. Nerv. & Ment. Dis. **99:** 256–263, March 1944.

In a series of 800 metrazol-treated cases, a fracture incidence of 26.1 per cent was found. All of the fractures occurred in the bodies of the dorsal spine, the fourth, fifth, and sixth vertebrae being the most frequently injured. The incidence was 37.2 per cent in males compared with 16.8 per cent in females. There was also an average of 2.8 bodies involved in the male compared with an average of 2.1 bodies per female. The authors believe that the greater muscular development in the male accounts for the higher incidence of fracture and greater number of bodies affected.

In 275 patients treated with curare and metrazol, the fracture incidence was 5.8 per cent: 7.3 per cent in males and 4.6 per cent in females. The degree of compression of the bodies and number of vertebrae involved were also less than with metrazol alone.

Kyphosis, scoliosis, arthritis, nuclear change, and old fractures are no contraindication to metrazol therapy. Osteoporosis, however, is a definite contraindication to the use of metrazol alone.

The authors conclude that curare should be used as a supplement whenever metrazol "shock" therapy is employed. E. W. GODFREY, M.D.

Acute Calcified Subacromial or Subdeltoid Bursitis. Frank R. Guido. California & West. Med. **60:** 69–72, February 1944.

Calcified subacromial or subdeltoid bursitis is not rare. In a series of over 6,000 unselected apparently healthy persons, Bosworth (J. A. M. A. **116:** 2477, May 31, 1941) found calcium deposits in one or both subacromial bursae in 2.7 per cent. The seat of the disease has been shown to be in the floor of the bursa, which is closely aligned with the tendons of the short rotators of the humerus, especially that of the supraspinatus muscle, and it is the tendon of this latter muscle that is most commonly involved.

The etiology of subacromial or subdeltoid bursitis is not known. The present consensus is that it is a gradual degenerative process, with multiple trivial traumata playing some part.

Symptoms include agonizing pain in the shoulder joint, tenderness over the greater tuberosity, pain on rotation, and inability to abduct the involved extremity, which is held rigidly at the side. Roentgenograms reveal a calcareous deposit (occasionally multiple deposits) over the greater tuberosity. This varies in density and thickness. Sometimes fluoroscopy is useful in its localization. Acute symptoms usually persist for about two weeks.

Although some patients experience spontaneous relief, the author is of the opinion that immediate incision of the involved bursa and curettage are the best form of therapy. For patients who refuse surgery, the injection of procaine hydrochloride into the bursa has received favorable mention in the literature. High-voltage roentgen therapy has also been employed, but the results have not been striking. Chapman (California & West, Med. **56:** 248, 1942. Abst. in Radiology **39:** 511, 1942), using this form of treatment in 54 cases, obtained no relief in 22 per cent, slight relief in 10 per cent, marked but incomplete relief in 46 per cent, and complete relief in 22 per cent. Other measures which have been tried with more or less effectiveness are physiotherapy, needling of the bursa, bursal irrigations, and ammonium chloride orally with rest of the involved arm and other supplementary measures.

The author reports a series of 11 cases. Surgical incision was done in 7, with prompt relief. In 3 cases immobilization and analgesics brought about relief in two or three weeks. One patient refused treatment.

MAURICE D. SACHS, M.D.

GYNECOLOGY AND OBSTETRICS

Venous Intravasation During Utero-Salpingography. E. Rohan Williams. Brit. J. Radiol. **17:** 13–17, January 1944.

Venous intravasation may occur during uterosalpingography as a result of direct trauma to the uterine mucosa by the cannula, the use of excessively high pressure, the performance of the test when the endometrium is physiologically deficient, *i.e.*, too near menstruation or too soon after curettage or dilatation of the cervix.

Fluoroscopically this complication is first seen as an ill-defined opacity near the uterine cavity, followed by the appearance of streak-like shadows radiating laterally. On films an interlacing network may be seen adjacent to the uterine cavity. As the intravasation increases, the oil is seen as coarse linear opacities in the uterine veins. It usually breaks up into globules as the injection proceeds.

In 6 cases reported by the author, no untoward symptoms occurred, but instances of chest pain and cough, probably the result of oil embolism, have been reported and two deaths from oil embolism have been recorded.

SYDNEY J. HAWLEY, M.D

Anencephaly with Antenatal Roentgen Diagnosis in Three Cases. W. C. Winn, H. H. Ware, Jr., and F. B. Mandeville. Virginia M. Monthly **71:** 145–148, March 1944.

Throughout the literature there seems to be general agreement that, whenever hydramnios is suspected clinically, a fetal monstrosity should be considered. Anencephaly is considered a monstrosity which can be diagnosed by adequate anteroposterior and lateral roentgenograms during the latter half of pregnancy.

A review of the obstetrical records at the Medical College of Virginia Hospitals for a period of ten years, 1933 to 1942, inclusive, revealed 71 cases with polyhydramnios. In 7 of these, gross deformity of the fetus was noted. There were 3 fetal monstrosities, 3 cases of erythroblastosis of the hydrops variety, and 1 infant had clubbed feet. One anencephalic monster was diagnosed roentgenographically before delivery.

Three case reports with roentgenograms are included in the paper. The authors conclude that roentgen examination of the abdomen in all cases of polyhydramnios is advisable. If a monstrosity is found, it is best to keep the mother in ignorance of the fact and interrupt the pregnancy.

The small quantity of roentgen radiation necessary for the examination, less than 1/50 of an erythema dose, is not considered dangerous for mother or fetus.

J. E. WHITELEATHER, M.D.

Fallacies in Soft Tissue Placentography. Chassar Moir, with a Comment by A. Louis Dippel. Am. J. Obst. & Gynec. **47:** 198–212, February 1944.

This paper is a criticism of the method of soft-tissue placentography described by Snow and his associates and by Dippel and Brown (see Absts. in Radiology **36**: 130, 756, 1941).

A representative series of roentgenograms was obtained from normal patients in the last eight weeks of pregnancy. In almost every instance a localized thickening of the uterine wall could be clearly seen. The corresponding thickening in their films was interpreted by Snow and Dippel and their co-workers as representing the placenta. The author, however, believes it to represent not only the placenta but also a localized excess of amniotic fluid, due to the uneven position of the fetus in utero. He objects also to the assumption that the placenta and liquor amnii cast shadows of different density, believing it much more likely that these shadows are indistinguishable.

To substantiate his views, Moir presents a series of experiments. In the first, roentgenograms were made of a normal fresh placenta suspended, fetal surface up-

ward, from a wire loop. The inner surface of the placenta was clearly outlined. A quantity of normal liquor amnii was then poured into the saucer-shaped placenta and a second exposure was made. The placental surface disappeared, indicating that the radiopacity of tissue and fluid were too nearly alike to show any differentiation even under these ideal conditions.

The second experiment was a repetition of one made by Weintraub and Snow, in which a roentgenogram was made of a stillborn fetus immersed in amniotic fluid, and confirmed in the main their conclusion that the dark band seen normally surrounding the fetus in utero is of fetal origin, the result of the relative transparency of the subcutaneous tissues of the fetus. It does not represent a layer of amniotic fluid.

Measurements were then made of 25 unselected placentas; the fact that these were notably less than the shadows usually interpreted as placentas is regarded as strong presumptive evidence that the latter were produced, at least in part, by amniotic fluid. This would explain the indentations or "digitations" on the "placental" surfaces mentioned by Snow.

To confirm his theory further, the author applied pressure by means of a sheet of firm cardboard over the abdominal wall where the uterine shadow was broadest. The resulting change in the roentgenographic appearance was considered to be consistent with a local excess of amniotic fluid. The fluid was also displaced by introduction of a small quantity of air per catheter, and roentgenograms were obtained with the patient in various positions to show the air-bubble. After air-injection, the localized thickening disappeared and the uterine wall was revealed in its true thickness, with no evidence of placenta.

In view of these experiments, the conclusion is reached that positive findings by soft-tissue placentography should be accepted with reserve, though negative findings may have a limited field of usefulness. The illustrations and diagrams are of high quality and merit study.

Dippel defends his position in an appended Comment. He questions the validity of roentgenograms of the delivered placenta as proof of Moir's contentions, since it cannot be considered roentgenographically identical with the undelivered and functioning placenta, which contains more blood. STEPHEN N. TAGER, M.D.

THE GENITO-URINARY TRACT

Pelvic Single Kidney: Report of Case. Oswald S. Lowsley and Joseph H. Menning. J. Urol. **51:** 117–127, February 1944.

A 36th case of pelvic single kidney is added to the 35 previously recorded in the literature. Among these cases, the mortality has been high, at least 9 patients having died as a result of their renal anomalies. Eighteen of the 36 patients have had anomalies, also, of the genital structures. For this reason these authors make the point that every case of genital abnormality should be investigated from the point of view of renal structure, and if anomalies are found these should be corrected.

The case report is of a boy of seven and a half years who had had repeated urinary tract infections. A pelvic single kidney was present, demonstrable by pyelogram and intravenous urogram. The function of this kidney was good. Several days after admission the kidney was elevated as high as possible in the abdomen and the ureter was reimplanted in the bladder. The technic of the operation is discussed and excellent drawings are included. The boy had been followed fifteen months and was still well.

The roentgenograms which are reproduced do not show the condition very clearly.

JOHN O. LAFFERTY, M.D.

Tuberculoma of the Kidney. Report of a Case. Stanley L. Wang and Albert V. Flaqué. J. Urol. **51:** 275–277, March 1944.

Tuberculoma is a vague term which the authors believe represents an unusual type of tuberculosis in which the lesion has the appearance of a tumor. The condition is rare, only two cases involving the kidney having been previously reported in the literature.

A 17-year-old white male was admitted with a complaint of "hematuria" of one week's duration. Two members of his family had died of tuberculosis. On cystoscopy the bladder showed spots of ecchymosis and an ulcerated sloughing area in the region of the left ureteral orifice. No pyelogram could be made of the left kidney, since a catheter would not pass up the ureter. Films of the abdomen showed a large renal shadow and an area of increased density in the lower pole. Intravenous urography showed delayed excretion on the left side; also, dilatation with apparent excavation at the upper pole. At operation the kidney appeared to be the seat of a tumor and nephrectomy was done. Two-thirds of the kidney was converted into a yellow-gray granular mass which was rubbery in consistency and produced a stenosis where the calices met the pelvis Sections revealed tuberculous granulation tissue in the form of miliary and conglomerate tubercles. Tubercles were found in the ureter.

The postoperative course was uneventful. The patient received routine follow-up treatment for postoperative urological tuberculosis, consisting of graduated rest, fresh air, special diet, tuberculin, and quartz lamp irradiations. DAVID KIRSH, M.D.

THE VASCULAR SYSTEM

Use of Phlebography and Lumbar Sympathetic Block in the Diagnosis of Venospasm of the Lower Extremities: Preliminary Report. E. M. Papper and Allison E. Imler. Surgery **15:** 402–412, March 1944.

In recent years, investigators have made increasing use of phlebography in the diagnosis and treatment of thrombophlebitis and pulmonary embolism resulting therefrom. There are still many controversial problems, however, connected with its use. One of these is the correct interpretation of filling defects in veins. Conceivably, these abnormalities may be due to partial or complete occlusion of the veins by thrombi, venous spasm, or both. The differentiation of these conditions is of practical and theoretical importance, as it is agreed by most writers that ligation is indicated in the presence of suppuration of the veins and phlebothrombosis.

This report presents an effective and simple technic whereby venous spasm may be differentiated from thrombosis with the aid of lumbar sympathetic block. The demonstration by phlebography of a uniform symmetrical narrowing of a vein with adequate concentration of contrast material is suggestive of venospasm. This diagnosis is confirmed if, following lumbar sympathetic block, the deformity disappears.

The authors describe the technic of phlebography and lumbar sympathetic block as performed for this purpose. If the first phlebographic study shows abnormalities, it is repeated to rule out technical errors such as inadequate concentration of media, and serial films of the involved area are made.

Three cases are reported, with illustrative roentgenograms. The first case showed a constriction of the popliteal vein which disappeared one hour after sympathetic block. In the second case, phlebography revealed normal deep circulation bilaterally except for a moderate symmetrical constriction of the left external iliac vein. After sympathetic block there was a definite increase in the width of the external iliac vein and relief persisted for eighteen hours. The third case exhibited thrombophlebitis of the right great saphenous vein, which had developed following an injury; ligation of this vein had been performed at another hospital five months after the onset. Phlebography revealed thrombosis of the deep femoral system with obstruction of the superficial femoral veins and thrombosis of the profunda femoris vein, with partial recanalization. These defects were again demonstrated by phlebography five weeks later, together with a uniform constriction of the distal end of the popliteal vein and the proximal portion of the anterior and posterior tibial veins which was not present previously. After lumbar sympathetic block, there was some widening of the constricted veins, although a defect in filling of the posterior tibial vein persisted. This case illustrates the coexistence of thrombosis and superimposed venospasm.

Commenting upon their observations, the authors state that the procedure described demonstrates, first, that there is an entity of venospasm; second, that thrombophlebitis may set up a reflex venal spasm about the diseased area. They suggest that the deep veins of the lower extremities are innervated by the lumbar sympathetic outflow and that it is possible, as demonstrated in their cases, for excessive tone of this outflow to produce spasm of the deep veins. Denervation by lumbar sympathetic block effectively removes the excess venous tone and allows the veins to dilate.

More experience must be acquired as to the correct time interval for phlebography after nerve block, and until more information can be obtained, it seems advisable to obtain serial roentgenograms.

J. E. WHITELEATHER, M.D.

RADIOTHERAPY

NEOPLASMS

Malignant Tumours of the Upper Jaw (The Skinner Lecture). B. W. Windeyer. Brit. J. Radiol. Part I. **16:** 362–366, December 1943. Part II. **17:** 18–24, January 1944.

In this discussion of tumors of the upper jaw, the author considers tumors of the maxillary sinus, ethmoidal tumors, and tumors involving the alveolar process; 141 cases of carcinoma and 12 of sarcoma are the basis of his study. Eighty-one patients were males and 72 females. These tumors occur rarely before the age of thirty-five, being most common between sixty and seventy. There is no correlation with chronic sinus disease.

Classification of tumors of the upper jaw is not altogether satisfactory. The antral tumors, however, may be divided into those arising in the region of the alveolar sulcus and those of the antro-ethmoidal angle. The spread may be through the mesial wall into the nose, into the ethmoid sinuses, through the orbital plate, or laterally into the cheek.

Histologic confirmation was obtained in 127 of the author's series—115 carcinomas and all the sarcomas. Re-examination of 75 specimens for the purposes of this report showed 22 keratinizing squamous-cell carcinomas, 23 squamous-cell carcinomas with little keratinization, 18 transitional-cell carcinomas, 9 undifferentiated spheroidal carcinomas, and 3 adenocarcinomas.

Metastases were found both in the regional lymph nodes and at distant locations. In 45 cases large nodes were present on admission, some of them, however, probably due to secondary infection. Generalized metastases were present in 14 cases.

Radiography is useful in confirming the clinical diagnosis and in determining the extent of the growth. It is not of value in detecting early recurrence. Biopsy is useful both for diagnosis and prognosis.

Treatment must be adjusted to the conditions and consists of surgery, implantation of radium, and external irradiation. Numerous methods were employed in the series recorded here. Since 1936 the general practice has been to give external irradiation either with roentgen rays or the teleradium unit, followed by surgery after the radiation reaction has subsided. Subsequent steps depend upon the condition found at operation. If there is residual tumor tissue, radium is applied. The plan of irradiation for a typical case is given in detail. Unless cervical lymph node metastases are present, the authors do not treat the neck. In 3 of their series a block dissection was done and in others x-ray or radium irradiation. Complications of treatment include bone necrosis, bronchopneumonia, and meningitis. Destruction of the eye, requiring subsequent removal, occurred in 10 cases.

Of 153 cases, 23 were considered too advanced for treatment. Of 69 patients treated between 1925 and 1935, 13 (18.8 per cent) were symptom-free at the end of five years. Of 30 treated in 1936–1939 (with the present technic), 11 (36.6 per cent) were free of symptoms at the end of three years. Only 1 of 9 patients with sarcoma treated prior to 1937 was symptom-free for five years. SYDNEY J. HAWLEY, M.D.

Carcinoma of the Nasopharynx. Charles M. Thompson and Elmer L. Grimes. Am. J. M. Sc. **207:** 342–348, March 1944.

Carcinoma of the nasopharynx comprises about 2 per cent of any large series of cancer cases and affects a group with a mean age of forty-five years. The incidence of cervical node metastasis upon hospital admission ranges in various reported series from 27.5 to 77 per cent. About 30 per cent of the patients mention nasal obstruction, discharge, or epistaxis as the first symptom. About 30 per cent have paralysis of one or more cranial nerves, the most frequently in-

volved being the fifth, sixth, and ninth, with the production of facial pain, diplopia, or dysphagia. These findings, and headache, are due to extension of the tumor into the skull. Since most of the tumors arise in or near the fossa of Rosenmüller, unilateral deafness, tinnitus and stuffiness in an ear are encountered. The average duration of symptoms before diagnosis is about fifteen months. Much time is usually lost on unwarranted operations such as tonsillectomies and mastoidectomies.

The term "lymphoepithelioma," which is applied to this neoplasm, arises from the fact that the site of origin is one in which lymphoid tissue abounds, and that the tumor is an anaplastic carcinoma with many lymphocytes mixed in coincidentally. The authors classify their 17 proved cases into three groups, the last with three subtypes, on the basis of the microscopic appearance. Group I lesions tend to metastasize widely to lungs and liver, while Group III lesions show a striking tendency to metastasize to the cervical nodes and extend directly to the middle cranial fossa.

Irradiation is the only accepted form of treatment. Profoundly ill patients are dramatically relieved temporarily by irradiation. Several patients were rendered free of the primary and cervical node lesions for weeks or months. Recurrences or metastases other than to the nodes proved radioresistant. The low percentage of cures is ascribed to late clinical recognition.

BENJAMIN COPLEMAN, M.D.

Diagnosis, Classification and Treatment of Tumours of the Salivary Glands. A Symposium. Reginald T. Payne, Margaret C. Tod, and M. Lederman. Brit. J. Radiol. **17:** 3–12, January 1944.

R. T. Payne: Tumors of the salivary glands constitute 1 to 2 per cent of all tumors. Pathologists still dispute their origin and classification. Among the congenital tumors which have been reported are hemangioma, lymphangioma, cysts, mixed tumors, and carcinoma (a single case). Lipomas are the only benign connective-tissue tumors of importance. Branchial cysts may involve the parotid region and other tumors may undergo cystic change. Pure adenoma and adenolymphoma are rare. Mixed tumors constitute the largest and most important group. These are commonest in the parotid. They may undergo malignant change. They recur frequently after removal, but seldom metastasize. Sarcoma is rare.

The treatment of salivary gland tumors is predominantly surgical. Each case must be individualized. Irradiation rarely reduces the size of these tumors, though it may toughen the capsule and make surgical removal easier. The operative complications are facial palsy, salivary fistula, and the auriculo-temporal syndrome. Because of the varied character of the tumors, it is difficult to make an accurate prognosis. Recurrence occurs in from 20 to 45 per cent of cases. The longer the follow-up the greater the number of recurrences found.

M. C. Tod: This part of the discussion is concerned solely with treatment and deals chiefly with parotid gland tumors, though mixed tumors in other sites are briefly considered. A group of 52 patients with mixed tumors of the parotid gland treated by surgery followed by radium implantation showed 98 per cent five-year cures. In 48 there was no recurrence, and in 3 recurrences were successfully treated. The dose employed was 6,000 to 6,500 r in seven or eight days.

Eleven cases of mixed tumor were treated by surgery and roentgen irradiation, but this procedure has been used for two years only, so that late results are not available. Only one of this group had required retreatment for recurrence.

Radiation alone was used chiefly in old patients with large tumors. The group is too small for the results to be significant. In some cases the tumors disappeared entirely, but not sufficient time has elapsed to evaluate recurrence.

Malignant tumors received the same types of treatment as the mixed tumors. Of 10 patients treated with surgery and implantation 3 were well at the end of three years. Of 7 treated by surgery and x-ray 2 were well at the end of three years. Of 7 treated by x-ray alone 2 were well at the end of two years. The inclusion in this group of lymphosarcoma, which is genuinely radiosensitive, accounts for some of the favorable results.

Surgical removal followed within a month by a single course of irradiation to tolerance seems to be the best method of treatment for mixed tumors. When surgical removal is impossible or contraindicated, irradiation to the highest possible dose is indicated.

M. Lederman: The following simple classification of salivary gland tumors is recommended as of practical value to the radiotherapist:

- Epithelial tumors
  - Benign
    - Mixed tumor type
    - Non-mixed tumor type
      - Adenoma
      - Adenolymphoma
      - Basalioma
  - Malignant
    - Mixed tumor type
    - Non-mixed tumor type
      - Adenocarcinoma
      - Malignant adenolymphoma
      - Basal-cell carcinoma
      - Squamous-cell carcinoma
- Connective-tissue tumors
  - Benign
    - Fibroma
    - Lipoma
    - Angioma
    - Lymphoid tissue
  - Malignant
    - Fibrosarcoma
    - Myosarcoma
    - Angiosarcoma
    - Lymphosarcoma

The general principles of treatment should be governed by the complementary relationship between surgery and irradiation. Radium is of special value because of its technical flexibility. Implantation alone may be used in benign and malignant tumors of limited volume, but it is only occasionally to be recommended for mixed tumors. It may also be employed postoperatively for benign tumors, but its action is too localized for use following excision of a malignant growth. It may supplement external irradiation and finally may be useful for local recurrences.

Intracavitary irradiation by radium tubes may be used in association with external irradiation for salivary gland tumors involving the nasal or nasopharyngeal cavity or the external auditory canal or with surgery when deep invasion has taken place.

Surface application of radium is rarely indicated. Teleradium, alone or in combination with other forms of therapy, is indicated for malignant tumors.

SYDNEY J. HAWLEY, M.D.

Primary Carcinoma of the Lung: Review of Thirty Proven Cases. Lester M. J. Freedman, Harold W. Jacox, and Reuben G. Alley. Pennsylvania M. J. **47:** 455–459, February 1944.

Forty-five cases of lung cancer registered in the Tumor Clinic (Western Pennsylvania Hospital) from 1936 to 1942 were reviewed for evaluation of diagnostic procedures and therapeutic results. This number represented about 2 per cent of all malignant neoplasms seen in the clinic. Thirty of the cases were proved by biopsy or postmortem examination. In this series there were 23 males and 7 females; the youngest patient was 32 and the oldest 77 years of age. Most of the patients were in the fifth and sixth decades. Cough, chest pain, and dyspnea were the symptoms most commonly seen. Weight loss, weakness, sweats, clubbed fingers, and hoarseness were also of fairly common occurrence.

The authors state that, "there are no roentgen findings pathognomonic of primary lung carcinoma." Any pathological condition that causes obstruction or irritation may produce the changes seen on the film. Enlarged hilar nodes, peribronchial infiltration, and atelectasis are the most common findings. In 30 per cent of the series reported a parenchymal mass was the predominant feature. Bronchoscopy is the chief diagnostic procedure, as 60 to 75 per cent of lung carcinomas involve the stem bronchi and hilar regions.

Aspiration biopsies were done in three cases in this series and a sufficient amount of tissue was obtained to make a positive diagnosis of carcinoma in all of them. High-voltage roentgen therapy was given in 11 cases, but while symptomatic relief was generally obtained for a time, the authors do not believe that life was prolonged to any degree. In the 19 untreated cases the average duration of life after admission was 1.4 months.

JOSEPH T. DANZER, M.D.

Regression of Bone Metastases from Breast Cancer after Ovarian Sterilization. Max Ritvo and Oscar S. Peterson, Jr. Am. J. Roentgenol. **51:** 220–228, February 1944.

The value of roentgen ovarian sterilization in the treatment of bone metastases from breast cancer is emphasized by the report of a series of cases from the Pondville Hospital (Massachusetts Department of Health). In properly selected cases, there is usually prompt and effective relief of pain. The lesions in the bones regress partially and in some instances entirely reossify. There is great improvement in the patient's general condition, with increased appetite and gain in weight. The mental status also improves. The question as to whether this form of treatment results in prolongation of life is still in doubt. It is the authors' belief that there has been unquestionable prolongation of life in some instances, while in others there has apparently been no appreciable improvement in this respect.

The total dosage employed is usually 2,000 to 3,600 r, varying with the size of the patient. Two to four fields, each measuring 15 × 15 cm., are used over the lower portions of the abdomen and lower back. One field is exposed daily in rotation and the customary single dose is 200 r, although it may safely be increased to 250 or 300 r. With the larger dosages a permanent sterilization usually results.

The general consensus of opinion is that about one-third or more of the cases treated may be expected to benefit from this form of treatment. There are no contraindications to ovarian sterilization, and it may be used whenever there is any reasonable hope of benefit. Eight case reports are included to illustrate the value of the procedure. Routine roentgen sterilization of all patients with cancer of the breast is not advocated, the treatment being recommended when osseous metastases have been demonstrated roentgenographically.

L. W. PAUL, M.D.

Carcinoma of the Cervix Coincident with Pregnancy. Charles R. Maino and Robert D. Mussey. Am. J. Obst. & Gynec. **47:** 229–244, February 1944.

Of 3,570 women with cervical carcinoma seen at the Mayo Clinic from July 1, 1909, to Feb. 28, 1941, 26 or 0.7 per cent were pregnant. The youngest patient of this small series was twenty-five years of age; the oldest was forty-one. The average time at which the carcinoma was found was the twenty-fourth week of pregnancy. In only one instance did carcinoma occur in a first pregnancy.

The symptoms of cervical carcinoma in the pregnant woman are those of the disease occurring independently, plus the signs of pregnancy. Vaginal hemorrhage is the most usual symptom. A biopsy and a pelvic examination should be done in every patient suspected of having a malignant lesion of the cervix.

Treatment depends upon two factors: the viability of the fetus and the operability of the lesion. *When the fetus is viable*, cesarean section is done; if the lesion is inoperable, irradiation follows; if the lesion is operable, a total abdominal hysterectomy is performed with postoperative irradiation. *When the fetus is not viable* and the lesion permits operation, a total hysterectomy is followed by irradiation; if the lesion is inoperable, sufficient irradiation is employed for treatment of the carcinoma and abortion generally follows.

In cases in which the lesion is operable, total abdominal hysterectomy has produced the best results. In 57 per cent of the cases in which this procedure was employed, the patient was free of recurrence five years later. It is difficult to say how greatly the prognosis is improved by postoperative irradiation, as the results vary. In only 2 operable cases was irradiation used alone; both terminated fatally.

The use of irradiation to control the growth of carcinoma until the fetus becomes viable is not without serious risk to both mother and child. According to the literature, abortion occurs in 24 per cent of cases so treated; in about 24 per cent of the remainder the offspring are defective, about half of this number being microcephalic idiots.

The outlook in this series of cases appeared to be at least as favorable as in cervical carcinoma unassociated with pregnancy. Five-year results were available in 20 cases. Six patients were living ten to twenty-three years after treatment; 14 were dead, 13 as a result of extension of the malignant lesion.

Whether the progress of carcinoma is stimulated, retarded, or unaffected by the coexistent pregnancy is a matter of dispute. The cause of the rapid acceleration of growth observed in some instances is not known.

STEPHEN N. TAGER, M.D.

NON-NEOPLASTIC DISEASE

Effect of Roentgen Rays on the Joint Effusions in Certain Nonspecific Articular Lesions in Humans, and on the Normal Joints of Dogs: Preliminary Report. Thomas Horwitz and Melvin A. Dillman. Am. J. Roentgenol. **51:** 186–201, February 1944.

Roentgen therapy was utilized in the treatment of 6 patients suffering with chronic non-specific synovitis with effusion in the knee joint. In 3 patients both joints were treated and in the remaining 3 only single joints. Two fields were employed, the inner and outer surfaces of the knee, and treatments were given usually at weekly intervals. The total dosages employed varied from case to case but in most instances were between 1,300 and 1,500 r total to each field, the individual doses varying from 198 to 215 r. In 4 patients a second course of therapy was given after an interval of six to ten weeks. In one patient a slight erythema was observed after the dose had reached 1,296 r, and in this case no improvement in the effusion occurred. In the remaining 5 patients (8 knee joints) definite improvement was observed. In 6 joints the effusion disappeared; in 4 there was some residual synovial thickening. In one instance there was only partial diminution in the severity of the effusion following the roentgen therapy, but a complete recovery followed a biopsy of the synovial membrane.

In order to determine the effect of roentgen therapy to the normal joint, experimental studies were carried out on 6 dogs. The left knee joints were treated, and the opposite joints were used as an untreated control. The largest total dose to any one joint amounted to 8,000 r, given over a period of three and a half months. None of the dogs gave evidence of any discomfort in the treated joints, and only one showed some loss of fur and superficial skin ulceration. No changes in the roentgenograms of the treated and control joints were observed. Gross examinations and histopathologic studies of the treated and control joints in 4 of the dogs revealed no abnormal changes in any of the specimens and no differences between the treated and control joints. Two of the dogs are still being observed in order to determine if there is any delayed roentgen-ray effect.

Reviewing their clinical material, the authors believe that roentgen therapy has been found beneficial in the *control of the joint effusion* and its attendant discomfort in certain non-specific synovial lesions, but that the residual synovial thickening, with residual pain in one patient, suggests that the progress and ultimate course of the underlying pathologic process is not favorably affected.

L. W. PAUL, M.D.

Rationale and Results of Roentgen Treatment of the Adrenal Glands in Angina Pectoris. W. Raab and A. B. Soule, Jr. Am. J. Roentgenol. **51:** 364–377, March 1944.

The theory advanced by Raab that anginal attacks are brought about by the acutely anoxiating effects of adrenalin discharges upon a heart muscle whose coronary arteries are sclerotic and thus unfit for adequate compensatory dilatation is based upon the following facts: (1) Adrenalin exerts a specific, intensely anoxiating effect upon the heart muscle. (2) Adrenalin is physiologically discharged from the adrenal glands into the blood stream under the influence of physical exercise, emotions, and cold, under the very conditions which usually elicit anginal pain. (3) The heart muscle possesses a greater tendency than other tissues to accumulate circulating excess amounts of adrenalin. (4) During physical exercise or exposure to cold the adrenalin content of the heart muscle increases while that of the adrenal glands diminishes. (5) Injection of adrenalin is likely to produce anginal symptoms in persons with coronary sclerosis. (6) Abnormally intense discharges of adrenalin into the blood stream during physical exercise were observed in all of 12 patients suffering from angina pectoris. (7) The electrocardiographic changes which occur during anginal attacks are practically identical with those following the administration of adrenalin. (8) Patients with tumors of the adrenal medulla often suffer from anginal attacks. (9) Conditions which are known to increase the secretion of adrenalin, such as tobacco smoking or overdosage of insulin or breathing of low oxygen concentrations, are likely to elicit anginal symptoms.

Raab previously irradiated the adrenal glands in 100 European patients with angina pectoris (Ann. Int. Med. **14:** 688, 1940). Seventy-six of these patients were either entirely freed of their complaints or at least improved for an average period of twelve and a half months. The present report is of 42 typical angina cases similarly treated in America. Two hundred roentgens (measured on the skin) were administered at each treatment. Six single treatments were given on consecutive days, three to the left upper quadrant of the abdomen posteriorly and three to the right, the left and right sides being treated on alternate days. Each area received 600 r as a total dose per series. When the treatment was repeated, the minimum interval between two successive series was six to eight weeks. In the improved cases the average number of series of treatments given was 1.6. Seventy-four per cent of those treated were either completely freed of their anginal complaints or at least improved for periods ranging between five and forty-five months with an average of two years up to the time of the report. Nine of the 11 unimproved patients had not received three series of roentgen treatments and thus cannot be considered as definite failures. No untoward side effects were noted. There is no evidence that irradiation of the adrenal region caused damage to the basic normal function of the glands. The essential effect of the treatment seems to consist in the abolition of the abnormally intense adrenalin discharges on effort, etc., through suppression of an existing state of abnormal irritability of the nervous mechanism of adrenal medullary secretion. Death occurred in 7 of the 42 patients. Three died suddenly during a state of clinical improvement, apparently from coronary occlusion. Three others died during relapses of their anginal condition after temporary improvement. One patient died from pneumonia.

CLARENCE E. WEAVER, M.D.

Tubercular Adenopathy in Young Children. Ira I. Kaplan. Arch. Pediat. **61:** 119–122, March 1944.

The greatest incidence of tuberculous adenopathy is in the twenty- to thirty-year age group, but a certain number of young children are affected, also. Often there is no association with pulmonary tuberculosis. The infection in 90 per cent of cases is bovine in origin.

Some years ago surgery was frequently resorted to

for tuberculous adenopathy, but radiation therapy has now come to be the treatment of choice in most clinics. Improvement is slow, but results are usually permanent and recurrence is rare. Scarring is less with radiation than with surgery. Large masses are often replaced by minute, painless, readily movable nodules, surrounded by loose elastic cellular tissue, which later undergoes still further regressive changes. Not to be overlooked, also, is the analgesic effect of x-rays here as in other inflammatory conditions.

In the author's series of 22 children, the total dosage was usually from 600 to 900 r; 100 to 150 r were given at a sitting. Medium voltage was employed in most instances; only occasionally was high voltage used, when the node involvement appeared to be more deeply seated. PERCY J. DELANO, M.D.

Koilonychia and Polycythaemia Vera. A. J. Glazebrook. Edinburgh M. J. **51:** 65–69, February 1944.

The author reports a case of koilonychia—so-called "spoon nails"—associated with polycythemia vera. Roentgen irradiation of the entire body reduced the red cell count and resulted in a large increase in the serum iron content. Healing of the nails occurred, but this the author attributes to the improved serum iron content rather than a direct action of the rays on the epithelial tissues, since the dosage was small.

Ringworm of the Scalp. Successful Use of Roentgen Rays to Epilate Local Areas of Infection. George M. Lewis and Mary E. Hopper. Arch. Dermat. & Syph. **49:** 107–108, February 1944.

The extent of infection in ringworm of the scalp can be accurately shown by examination under filtered ultraviolet light. When examined under such a light the hairs infected with fungi are fluorescent. For treatment most dermatologic departments use the five-exposure epilation method. If the infected area has been clearly delineated by this method, the epilation dose can be restricted to the region involved.

JOSEPH T. DANZER, M.D.

EXPERIMENTAL STUDIES

Role of Inflammation in the Induction of Cancer by X-Rays. H. Burrows and J. R. Clarkson. Brit. J. Radiol. **16:** 381–382, December 1943.

Foci of infection were produced in the groins of rabbits by the injection of silica in oleic acid and kaolin in water. When inflammation developed, the areas were treated with 600 r (250 kv., 4 ma., 0.5 mm. Cu filter). In 8 of 9 rabbits so treated, sarcoma developed in the involved area. The earliest appeared twenty-two months after irradiation. In 2 of the animals there were no metastases, while 6 had metastases at the time of death.

A second series was treated with 2,000 r, 600 r, and 250 r (150 kv. and 0.3 mm. Cu filter). Other rabbits were injected with irritants but no irradiation was given. Of 8 rabbits receiving 2,000 r or 600 r sarcoma developed in 5, the earliest appearing in twenty-two months. No tumors appeared in the group injected but not irradiated. In another control group of 12 irradiated animals, without the inflammatory process, 2 showed tumors near but not in the irradiated area. These tumors were not of the same histologic type as those seen in the rabbits with inflammation.

Similar experiments were tried on guinea-pigs but only a few survived. None of these showed tumors.

SYDNEY J. HAWLEY, M.D.

Spatial Distribution in Irradiated Tissue and Its Relation to Biological Effects. D. E. Lea. Brit. J. Radiol. **16:** 338–339, November 1943.

Energy is dissipated in tissue irradiated by x-rays, neutrons, or radioactive radiations mainly by ionization and excitation. At present excitation is thought to be of little or no importance. To understand the direct effect of irradiation, then, it is necessary to know the amount of ionization produced by one r and its manner of distribution.

Working with chromosomal aberrations in irradiated microspores of Tradescantia, it was found that if the microspores were irradiated in the early stages of mitosis breaks were produced in the chromosome threads.

One "roentgen" of neutrons administered to a cell results in 1.56×10^{-3} protons crossing each area of one square micron. The area of the chromosomes in one grain is approximately known. From this it is deduced that with a dose of 8 r the average number of occasions on which a proton traverses a chromosome is one per pollen grain. This is also the dose required experimentally to get an average break of one chromosome per pollen grain. Unless this is regarded as coincidence, it must be concluded that a chromosome is broken each time a proton traverses it.

When medium length x-rays are used, twenty times as many ionizing particles are produced. Thus many more ionizing particles traverse chromosomes, yet fewer breaks are produced. It follows that this lesser efficiency is due to the small number of ionizations produced by an electron per square micron. The number of ions per micron varies with the length of the path of the electron, being smaller at the beginning and larger at the end. The length of the effective terminal path of the electron is 0.25 micron. We can now predict that the most effective wave length is 4 Angstroms. Experimental trials agreed satisfactorily with this. SYDNEY J. HAWLEY, M.D.

Investigations Into the Degree of Scattered Radiation Received by X-Ray Workers During Routine Diagnostic Examinations in a Military Hospital Department. J. A. C. Fleming. Brit. J. Radiol. **16:** 367–370, December 1943.

By ionization measurements tests were made, under conditions as near as possible to working conditions under a heavy schedule, of the amount of scattered radiation received by unprotected workers. If they stayed two and a half feet away from the direct beam during both fluoroscopy and radiography they received less than the maximum tolerance dose of 10^{-3} r per second. If films are made during fluoroscopic examination, the unprotected worker should be five feet away from the direct beam.

SYDNEY J. HAWLEY, M.D.